TM 11-5826-200-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

See C1,2

FIELD AND DEPOT MAINTENANCE

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RADIO RECEIVER R-746/AR

HEADQUARTERS, DEPARTMENT OF THE ARMY
MAY 1959

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on the 222-volt plate and power supply circuits, or on the 115-volt ac line connections.

DON'T TAKE CHANCES

Jm 8.31.5

mt 9/2/65

Changes in force: C 1 and C 2

TM 11-5826-200-35
C 2

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CHANGE
No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *29 July 1965*

Field and Depot Maintenance Manual
RECEIVER GROUP AN/ARA-54

TM 11-5826-200-35, 13 May 1959, is changed as follows:

Note. The parenthetical reference to previous changes (*example:* "page 5 of C 1") indicates that pertinent material was published in that change.

Page 3, paragraph 1.1 (page 1 of C 1). Add paragraph 1.2 after paragraph 1.1.

1.2. Equipment Changes Resulting From MWO 11-5826-200-35/1

a. For those receivers and control units modified by MWO 11-5826-200-35/1, the AN/ARA-54 provides reception for 20 frequencies as authorized by the Federal Aviation Agency (FAA). The MWO modifies the receiver and control unit as follows:

(1) Installation of 10 additional crystal units in Receiver, Radio R-746/AR and R-746A/R.

(2) Replacement of switch section S2 in Control, Radio C-2605/AR (figs. 33.4 and 33.5).

(3) Application of a new crystal location decal on top of CV103 in the receiver (fig. 27). The decal lists the proper plug-in sequence of crystal units in the receiver to comply with the localizer-glide slope frequency pairing as authorized by the FAA.

b. When the MWO has been applied, the AN/ARA-54 will be capable of being tuned to any one of the 20 frequencies listed in the chart below. Operation for the modified equipment will be identical with that for the unmodified equipment except that the modified equipment will have an additional 10 channels.

Localizer frequency (mc)	Glidepath frequency (mc)	Radio Receiver R-746/AR crystal frequency (kc)	Circuit symbol
108.1	334. 7	11696. 296	Y119
108.3	334. 1	11674. 074	Y117
108.5	329. 9	11518. 518	Y103
108.7	330. 5	11540. 740	Y105
108.9	329. 3	11496. 296	Y101
109.1	331. 4	11574. 074	Y108
109.3	332. 0	11596. 296	Y110
109.5	332. 6	11618. 518	Y112
109.7	333. 2	11640. 740	Y114
109.9	333. 8	11662. 962	Y116
110.1	334. 4	11685. 185	Y118
110.3	335. 0	11707. 407	Y120
110.5	329. 6	11507. 407	Y102
110.7	330. 2	11529. 629	Y104
110.9	330. 8	11551. 851	Y106
111.1	331. 7	11585. 185	Y109
111.3	332. 3	11607. 407	Y111
111.5	332. 9	11629. 629	Y113
111.7	333. 5	11651. 851	Y115
111.9	331. 1	11562. 962	Y107

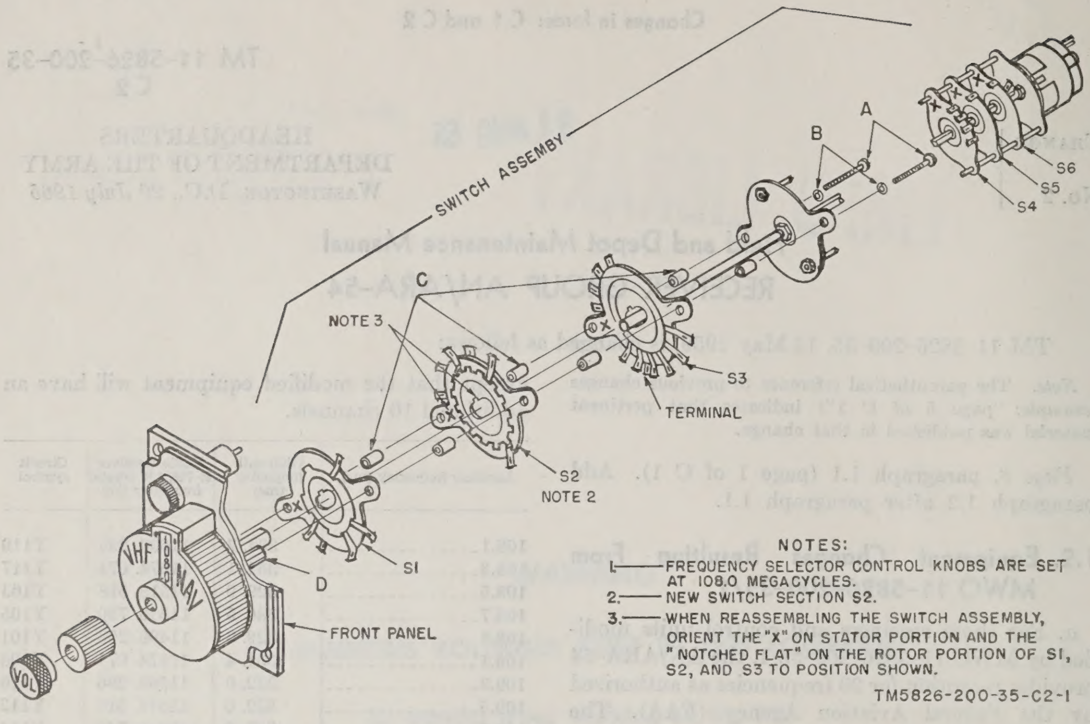
Page 46, figure 32. Add the following note to figure 32.

NOTE

RECEIVERS MODIFIED BY MWO 11-5826-200-35/1 WILL HAVE 20 CRYSTALS INSTALLED IN THE CRYSTAL RELAY BANK SUBCHASSIS.

Page 47, paragraph 42*c*(1), *d*(1), and *e*(1). After "figure 33" add: figures 33.4 and 33.5.

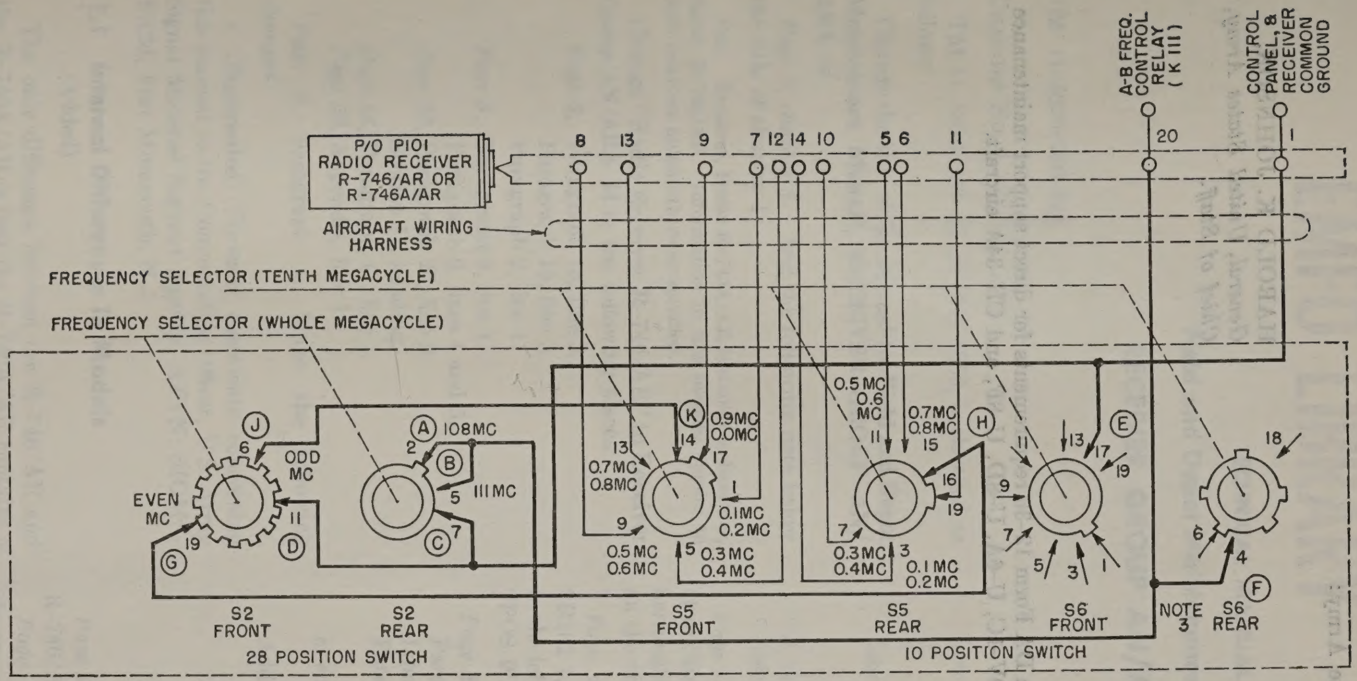
Page 48, figure 33.3 (page 8 of C 1). Add figures 33.4 and 33.5 after figure 33.3.



NOTES:
1.—— FREQUENCY SELECTOR CONTROL KNOBS ARE SET AT 108.0 MEGACYCLES.
2.—— NEW SWITCH SECTION S2.
3.—— WHEN REASSEMBLING THE SWITCH ASSEMBLY, ORIENT THE "X" ON STATOR PORTION AND THE "NOTCHED FLAT" ON THE ROTOR PORTION OF S1, S2, AND S3 TO POSITION SHOWN.

TM5826-200-35-C2-1

Figure 33.4. C–2605/AR switch assembly modified by MWO 11–5826–200–35/1, exploded view.



NOTES:

1.—SWITCHES ARE SHOWN IN 108.0 MC POSITION. CLOCKWISE ROTATION OF FREQUENCY SELECTOR SHAFTS INCREASE FREQUENCY.

2.—ALL SWITCH SECTION TERMINALS (INCLUDING TERMINAL PERFORATIONS, BOTH FRONT & REAR) ARE NUMBERED CLOCKWISE STARTING WITH FIRST TERMINAL (OR PERFORATION) TO RIGHT OF INSCRIBED "X" ON SWITCH SECTION AS VIEWED FROM KNOB END OF SWITCH SHAFT. THE MOUNTING HOLES OF SWITCH SECTIONS S4, S5, & S6 ARE COUNTED AS TERMINAL PERFORATIONS.

3.—FRONT & REAR ROTORS OF S6 ARE ELECTRICALLY CONNECTED. SWITCH TERMINALS 17 Ⓔ AND 4 Ⓕ OF SWITCH SECTION S6 ARE USED AS TIE POINTS ONLY.

4.—HEAVY LINES INDICATE CIRCUIT MODIFICATION.

TM5826-200-35-C2-2

Figure 33.5. C–2605/AR switch assembly modified by MWO 11–5826–200–35/1, schematic diagram.

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:
J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12–36 requirements for direct support maintenance literature for CV–2B, OV–1A, OV–1B, OV–1C, U–6A, U–8D, U–8F, and CH–34A aircraft.

U.S. GOVERNMENT PRINTING OFFICE: 1965

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TECHNICAL MANUAL

Field and Depot Maintenance Manual

RECEIVER GROUP AN/ARA-54

TM 11-5826-200-35
CHANGES No. 1

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *7 June 1962*

TM 11-5826-200-35, 13 May 1959, is changed as follows:

Change the title of the manual to: **Field and Depot Maintenance Manual, RECEIVER GROUP AN/ARA-54.**

Page 3, chapter 1. Add the following note below the title of chapter 1:

Note. Receiver, Radio R-746A/AR is similar to Receiver, Radio R-746/AR. Information in this manual applies to both receivers unless otherwise specified.

Change "Radio Receiver R-746/AR" to **Receiver Group AN/ARA-54** in the following places:

Page 3, Paragraph 1*a*, line 2.
Paragraph 1*b*, line 3.
Paragraph 2, line 1.
Page 5, Paragraph 8, line 1.
Paragraph 9, lines 1 and 5.
Page 33, Paragraph 27, line 2.
Section II, heading.
Page 45, Paragraph 41, line 1.
Page 53, Appendix, line 1.

Page 3, paragraph 1. Make the following changes:

c. (Superseded) Forward comments concerning this manual to the Commanding Officer, U.S. Army Signal Materiel Support Agency, ATTN: SIGMS-PA2d, Fort Monmouth, N.J.

1.1 Internal Differences in Models (Added)

The only difference between the R-746/AR and the R-746A/AR is that the R-746A/AR contains a filter network consisting of capacitors C177 and C178 and resistors R187 and R188. The filter network is connected in the rectifier circuit as shown in figure 34.1.

Page 6, paragraph 11. Make the following changes:

Line 6. Add the following after "Indicator ID-48/ARN": (TM 11-520 and TM 11-5826-207-10).

Line 7. Add the following after "Course Indicator ID-249A/ARN": (TM 11-12R5-2ARN14-2).

d, line 6. Change "seelctor" to **selector.**

Delete the fourth sentence.

Page 7, paragraph 12*a*, line 3. Add the following after "Radio Receiver R-746/AR": when the ramshorn antenna (TM 11-5826-200-12) is not available on the aircraft.

Page 24, figure 19. Connect a resistor labeled "R162 1,000" from the junction of R158 and R161 to the left of the junction of R164 on the line labeled "POS WITH 90 CPS > 150 CPS."

Page 26. Make the following changes:

Paragraph 20, line 2. Change "9" to: **90.**

Line 4. Change "army" to: **arm.**

Paragraph 22, heading. Change "(fig. 21)" to: **(figs. 21 and 34.1).**

c, second sentence. Change "pi-section filter" to: **choke input, double L-section filter.**

Add the following after the second sentence: A filter network (fig. 34.1), which consists of capacitors C177 and C178, and resistors R187 and R188, provides additional filtering in the primary ground return of Z101 (R-746A/AR).

Page 27, figure 21, caption. After "circuits" add: R-746/AR only.

Page 28, paragraph 23. Make the following changes:

Lines 19 and 22. Change "four" to: **five.**

Line 20. Change "Mounting MT-791/U" to: **Mounting MT-1762/AR.**

Line 21. After "R-746/AR," add: Receiver, Control C-2065/AR. Add the following note after paragraph 23:

Note. For a wiring diagram of the C–2065/AR, refer to the configuration manual of the aircraft in which the equipment is installed.

Page 32, paragraph 26*c*, chart, step 4, corrective measures column.

After the last item, add: Check control panel.

Page 33, paragraph 27, chart, technical manual column, line 4.

Change "TM 11–5083" to: **TM 11–6625–274–12**.

Page 40, paragraph 30*d*, chart. Make the following changes:

Item 1, probable trouble column. After line 2, add: Defective control panel VOL switch.

Procedure column. After line 2, add: Check continuity of switch. Replace switch (par. 42*c*).

Item 7, probable trouble column. After line 2, add: Defective frequency selector switch (C–2065/AR).

Procedure column. After line 4, add: Check continuity of switch. Repair or replace switch (par. 42*e*).

Page 47, paragraph 42*c*, heading. Add the following note after the heading:

Note. For a wiring diagram of the C–2065/AR, refer to the configuration manual of the aircraft in which the equipment is installed.

Page 48, figure 33, caption. Change "Receiver Control" to: **Control, Receiver.**

Page 50. Add chapter 4.1 after chapter 4.

CHAPTER 4.1

FOURTH ECHELON TESTING PROCEDURES

45.1. General

a. Testing procedures are prepared for use by Signal Field Maintenance Shops and Signal Service Organizations responsible for fourth echelon maintenance to determine the acceptability of repaired signal equipment. These procedures set forth specific requirements that repaired signal equipment *must* meet before it is returned to the using organization. The testing procedures may also be used as a guide for testing equipment repaired at third echelon if the proper tools and test equipment are available. A summary of the performance standards is given in paragraph 45.9.

b. Each test depends on the preceding one for certain operating procedures and, where applicable, for test equipment calibrations. Comply with the instructions preceding the body of each chart before proceeding to the chart. Perform each test in sequence. Do not vary the sequence. For each step, perform all the actions required in the test equipment control setting and equipment under test control setting columns; then perform each specific test procedure and verify it against its performance standard.

45.2. Test Equipment and Other Equipment Required

All test equipment, tools, materials, and other equipment required to perform the testing procedures given in this section are listed in the following charts and are authorized under TA 11–17 and TA 11–100 (11–17); or TOE 11–158D and TA 11–101 (11–158); or are repair part items of the subject equipment authorized for stockage at fourth echelon levels.

a. Test Equipment.

Nomenclature	Federal stock No.	Technical reference
Maintenance Kit, Electronic Equipment MK–428/AR.	5821–682–2692	TM 11–5826–213–12.
Signal Generator AN/GRM–4.	7CAC–363885 (AF No.)	
Frequency Meter AN/USM–26.	6625–692–6553	TM 11–5057
Converter, Frequency AN/USA–5.	----------------	Manual for Hewlett Packard HP–525B.
Comparator, Frequency CM–77/USM.	----------------	Manual for Hewlett Packard HP–540B.
Signal Generator AN/USM–44(*)[a].	6625–669–4031	
Electronic Voltmeter ME–30(*)/U[b].	6625–669–0742	TM 11–6625–320–12.

[a] Indicates AN/USM–44 and AN/USM–44A.
[b] Indicates ME–30A/U, ME–30B/U, and ME–30C/U.

b. Tools. Tool Kit TK–87/U (FSN 5180–690–4452) and Tool Kit TK–88( )/U (FSN 5180–893–1888) contain all the tools necessary to maintain Receiver Group AN/ARA–54.

c. Materials.

Nomenclature	Federal stock No.	Technical reference
Resistor, Variable 5,000 ohms 2W[a].	----------------	None
Clip, Electrical, Alligator (2 ea).	5940–186–8933	None
Hookup Wire No. 20 AWG insulated (approx 4 ft)[b]	6145–160–5031	None

[a] Indicates repair part item (R–161) of R–746/AR.
[b] Any insulated hookup wire may be used.

d. Other Equipment.

Nomenclature	Federal stock No.	Technical manual
Power Supply PP–1104A/G	6130–542–6385	TM 11–5126
Headset HS–30–U	5965–164–7259	None
Cord CD–605 (used with HS–30–U).	6625–170–9608	None
Cord Assembly CX–1332/U	5995–184–6497	None
Battery, Dry BA–31	6135–120–1019	None

45.3. Special Requirements

a. It is advisable but not mandatory that these tests be conducted in a screen room.

b. Any *variable* power supply capable of delivering 30 volts dc at 5 amperes may be used as the primary power source for these tests.

c. As of the date of this change, Radio Receiver R–746/AR is equipped to receive 10 commercially authorized frequencies. If this authorization is expanded and the receiver under test is so equipped, Step No. 5 of paragraph 45.7*d* will include all operable channels.

d. Comparator, Freuqency CM–77/USM has commercial nomenclature, Hewlett Packard, HP–540B. Converter, Frequency AN/USA–5 has commercial nomenclature, Hewlett Packard, HP–525B. If the above items are not available to perform these tests, Frequency Meter AN/URM–81 may be substituted along with the instructions in the calibration book packed with the equipment. Refer to the summary of performance standards (par. 45.9) for acceptable limits of performance.

45.4. Modification Work Orders

There were no modification work orders (MWO's) in effect for these equipments as of the date of the performance of the tests. Any MWO's pertaining to these equipments, which may have been published since the date of the tests, will be listed in DA Pam 310–4. MWO's not classed URGENT should not be reason for rejection.

45.5. Physical Tests and Inspection

a. Test Equipment and Materials. None.

b. Test Connections and Conditions.

(1) Do not make any connections to the receiver while performing the tests.

(2) Remove the side panels (par. 42*a*).

(3) Remove the cover (TM 11–5826–200–12) from the front of the receiver by sliding the slide fasteners (not shown) away from the pins.

c. Test Procedure.

Step No.	Test equipment control settings	Equipment under test controls settings	Test procedure	Performance standard
1	N/A	Controls may be in any position.	*a.* Inspect all controls for evidence of physical damage or looseness. *b.* Rotate all controls to their limits of travel. *c.* Inspect antenna connector, test connector, and jack for evidence of damage or looseness. *d.* Inspect crystal relay bank subchassis for cleanliness and absence of moisture. *e.* Remove tube shields. *f.* Check vacuum tubes for firmness in their sockets. *g.* Replace tube shields. *h.* Inspect all wiring and cable harnesses for evidence of cracked or frayed insulation. *i.* Inspect all metal surfaces for condition of finish. *Note.* Touchup painting is recommended in lieu of refinishing whenever practicable.	*a.* Controls should not show evidence of damage and should be securely mounted. *b.* Controls should operate smoothly without evidence of sticking or binding. *c.* Connectors and jack should not show evidence of damage and should be securely mounted. *d.* Chassis should be free of dust, dirt, or condensation. *e.* None. *f.* Tubes should be firmly seated. *g.* Tube shields should lock in place. *h.* Wiring should be free of cracks or frays. *i.* All metal surfaces intended to be painted should not show bare metal.

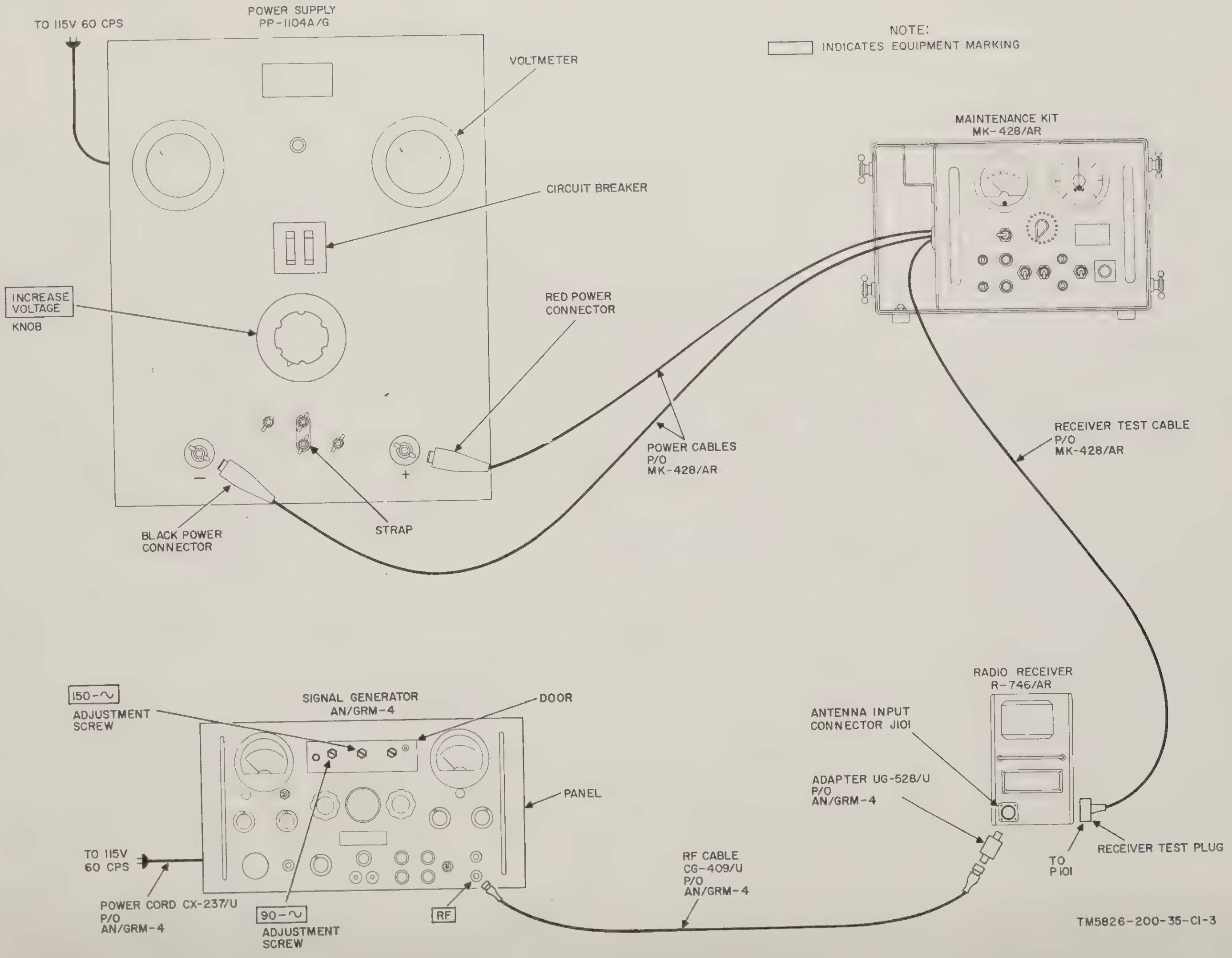

Figure 33.1. (Added) *Balance, audio, deflection, and flag alarm control test connections.*

45.6. Balance, Audio, Deflection, and Flag Alarm Control Tests

a. Test Equipment and Materials.

(1) Maintenance Kit, Electronic Equipment MK–428/AR.

(2) Signal Generator AN/GRM–4.

(3) Power Supply PP–1104A/G.

b. Test Connections and Conditions. Connect the equipment as shown in figure 33.1.

Note. Adapter UG–528/U is a 6-decibel (db) attenuator.

c. Calibration of AN/GRM–4.

(1) Set the controls as indicated in the following chart and allow a 15-minute warmup period before proceeding with (2) below.

Control	Setting
MOD LEVEL	Pointer to index marker (vertical)
DB TONE RATIO	CAL 90 ∼
FREQUENCY	332.0
0–50%–0–100%	0–100%
MOD	OFF
POWER ON HEATER	ON
CARRIER ADJUST	Fully counterclockwise
CARRIER	RF
OUTPUT LEVEL	Adjust for 700 on UV (Microvolts) dial

(2) Adjust the CARRIER ADJUST control clockwise until the needle of the CARRIER MONITOR meter is positioned at the redline.

(3) Operate the MOD switch to 90–150 ∼.

(4) Adjust the 90-∼ adjustment screw (located behind the door on the panel) until the PERCENT MODULATION meter indicates 40 percent (40 on the 0-to-100 scale).

(5) Operate the DB TONE RATIO switch to CAL 150 ∼.

(6) Adjust the 150-∼ adjustment screw (located behind the door on the panel) until the PERCENT MODULATION meter indicates 40 percent (40 on the 0-to-100 scale).

		CURRENT meter. c. Operate MK–428/AR RECEIVER ON-STANDBY switch to STANDBY and proceed to paragraph 45.7.	c. None.

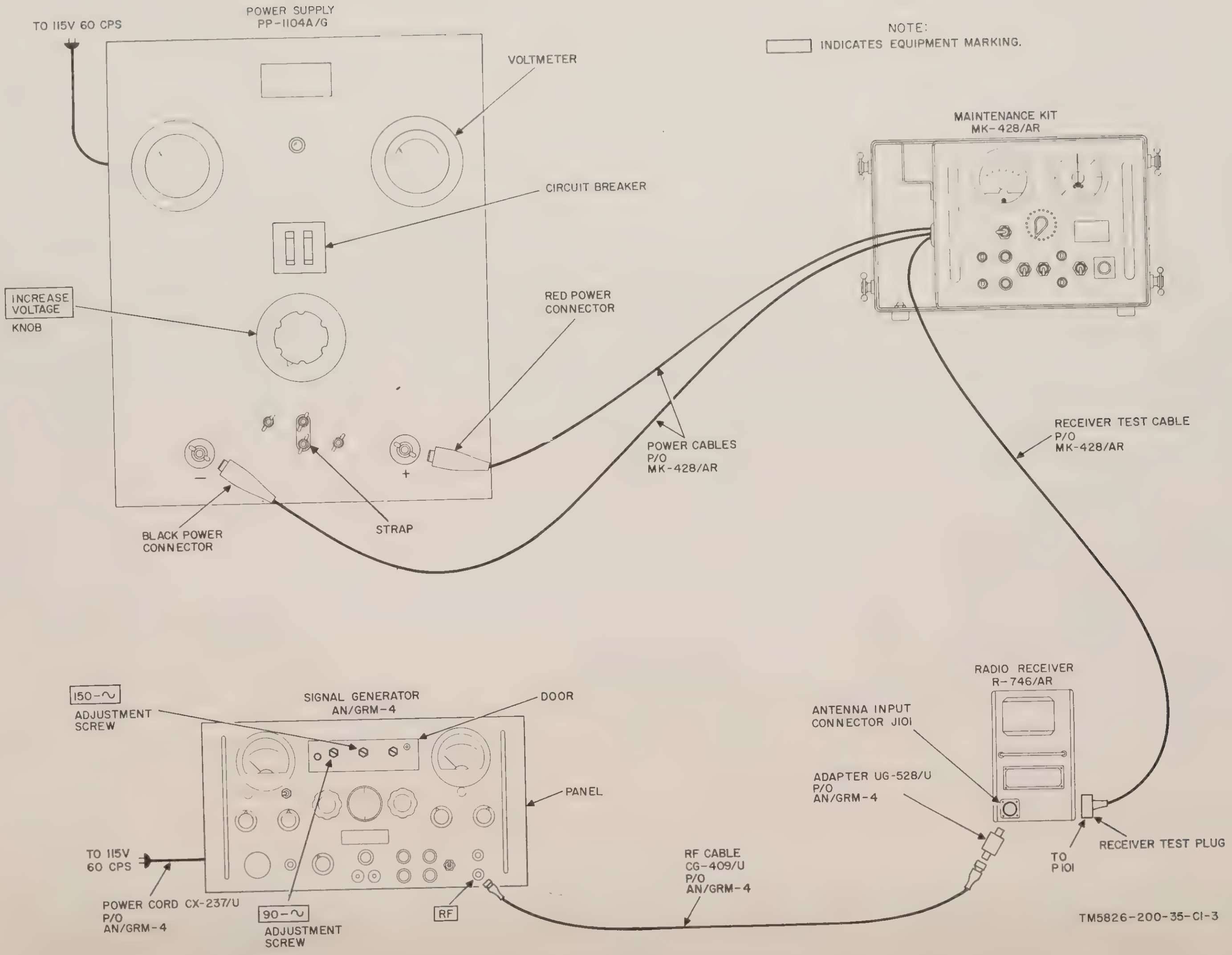

Figure 33.1. (Added) *Balance, audio, deflection, and flag alarm control test connections.*

45.6. Balance, Audio, Deflection, and Flag Alarm Control Tests

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(1) Maintenance Kit, Electronic Equipment MK–428/AR.
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Note. Adapter UG–528/U is a 6-decibel (db) attenuator.

c. Calibration of AN/GRM–4.

(1) Set the controls as indicated in the following chart and allow a 15-minute warmup period before proceeding with (2) below.

Control	Setting
MOD LEVEL	Pointer to index marker (vertical)
DB TONE RATIO	CAL 90 ∼
FREQUENCY	332.0
0–50%–0–100%	0–100%
MOD	OFF
POWER ON HEATER	ON
CARRIER ADJUST	Fully counterclockwise
CARRIER	RF
OUTPUT LEVEL	Adjust for 700 on UV (Microvolts) dial

(2) Adjust the CARRIER ADJUST control clockwise until the needle of the CARRIER MONITOR meter is positioned at the redline.
(3) Operate the MOD switch to 90–150 ∼.
(4) Adjust the 90-∼ adjustment screw (located behind the door on the panel) until the PERCENT MODULATION meter indicates 40 percent (40 on the 0-to-100 scale).
(5) Operate the DB TONE RATIO switch to CAL 150 ∼.
(6) Adjust the 150-∼ adjustment screw (located behind the door on the panel) until the PERCENT MODULATION meter indicates 40 percent (40 on the 0-to-100 scale).
(7) Operate the DB TONE RATIO switch from CAL 150 ∼ to CAL 90 ∼ several times and check to see that the PERCENT MODULATION meter indicates 40 percent in each case. If it does not, set the DB TONE RATIO switch to CAL 90 ∼ and repeat the procedures given in (4), (5), and (6) above.

d. Test Procedure.

Step No.	Test equipment control settings	Equipment under test controls settings	Test procedure	Performance standard
1	*PP–1104A/G* Circuit Breaker: On INCREASE VOLTAGE: For 27.5 volts on volt-meter. *MK–428/AR* METER RANGE: 0–1MA CHANNEL: 13 INT LOAD-EXT IND: INT LOAD RECEIVER ON-STANDBY: STANDBY POWER: ON *AN/GRM–4* DB TONE RATIO: 0	N/A	*a.* Allow 15-minute warmup period before proceeding.	*a.* None.
			b. Adjust PP–1104A/G INCREASE VOLTAGE knob until voltmeter indicates 27.5 volts.	*b.* None.
			c. Note and record indication of AN/GRM–4 PER CENT MODULATION meter.	*c.* None.
			d. Operate MK–428/AR RECEIVER switch to ON	*d.* None.
			e. Adjust PP–1104A/G INCREASE VOLTAGE knob until indication of 27.5 volts is obtained on voltmeter.	*e.* None.
			f. Rotate R–746/AR balance control (R–156) fully clockwise. Note indication on MK–428/AR DEVIATION CURRENT meter.	*f.* MK–428/AR DEVIATION CURRENT meter should not indicate less than 20 microamperes to right of 0.
			g. Rotate R–746/AR balance control (R–156) fully counterclockwise. Note and record the indication of MK–428/AR DEVIATION CURRENT meter.	*g.* MK–428/AR DEVIATION CURRENT meter should not indicate less than 20 microamperes to left of 0.
			h. Rotate R–746/AR balance control (R–156) clockwise until MK–428/AR DEVIATION CURRENT meter indicates 0.	*h.* None.
2	As last indicated:	N/A	*a.* Operate AN/GRM–4 DB TONE RATIO switch counterclockwise to 2.0.	*a.* None.
			b. Rotate R–746/AR audio gain control (R–171) fully clockwise. Note and record indication of MK–428/AR DEVIATION CURRENT meter.	*b.* MK–428/AR DEVIATION CURRENT meter should not indicate less than 100 microamperes to right of 0.
			c. Rotate R–746/AR audio gain control (R–171) fully counterclockwise. Note and record indication of MK–428/AR DEVIATION CURRENT meter.	*c.* MK–428/AR DEVIATION CURRENT meter should indicate less than 75 microamperes to right of 0.
			d. Rotate R–746/AR deflection sensitivity control (R–164) fully clockwise.	*d.* None.
			e. Rotate R–746/AR audio gain control (R–171) clockwise until MK–428/AR DEVIATION CURRENT meter indicates 140 to right of zero.	*e.* None.
			f. Rotate R–746/AR deflection sensitivity control (R–164) fully counterclockwise. Note and record indication of MK–428/AR DEVIATION CURRENT meter.	*f.* MK–428/AR DEVIATION CURRENT meter should indicate less than 35 microamperes to right of 0.
			g. Rotate R–746/AR deflection sensitivity control (R–164) clockwise until MK–428/AR DEVIATION CURRENT meter indicates 80 to the right of 0.	*g.* None.
			h. Operate AN/GRM–4 DB TONE RATIO switch clockwise to 2.0. *Note.* If performance standard in *h* above is not met, readjust deflection sensitivity control (R–164) for average 80 indication for both 2.0 counterclockwise setting and 2.0 clockwise setting of AN/GRM–4 DB TONE RATIO switch.	*h.* MK–428/AR DEVIATION CURRENT meter should indicate 80 microamperes to left of 0.
3	As last indicated except: *AN/GRM–4* OUTPUT LEVEL: Adjust for 0.1V on UV dial.	N/A	*a.* Adjust R–746/AR flag alarm control (R–161) for maximum indication on MK–428/AR FLAG CURRENT meter.	*a.* MK–428/AR FLAG CURRENT meter should not indicate less than 0.85 milliamperes on 0–to–1 scale.
			b. Operate MK–428/AR METER RANGE switch to 0-0.5 MA and ADJUST R–746/AR flag alarm control (R–161) until indication of 0.275 is obtained on bottom scale of MK–428/AR FLAG CURRENT meter.	*b.* None.
			c. Operate MK–428/AR RECEIVER ON-STANDBY switch to STANDBY and proceed to paragraph 45.7.	*c.* None.

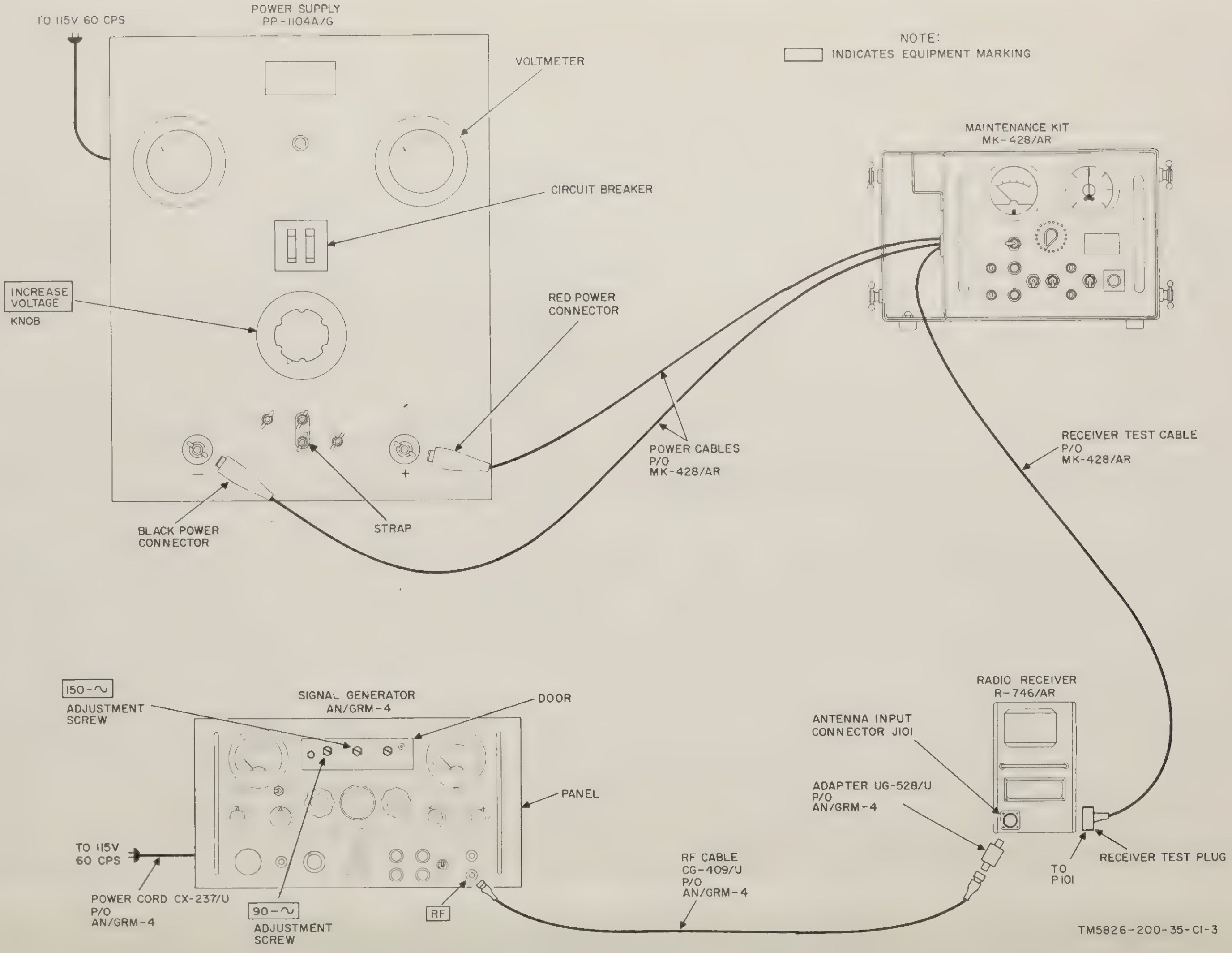
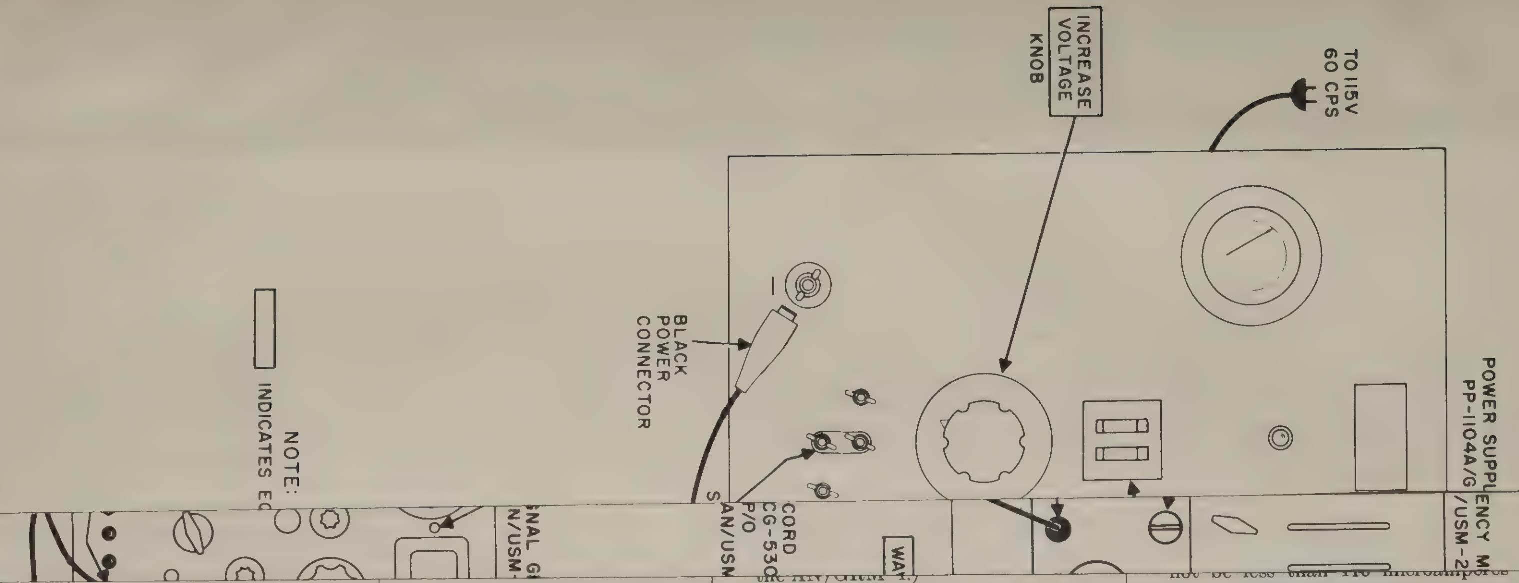


Figure 33.2. (Added) ***Primary voltage, agc, and sensitivity test connections.***



			g. Repeat step 1*e* above. *h.* Rotate AN/GRM-4 OUTPUT LEVEL control until μV dial indicates 0.1V. *i.* Note and record indication on MK-428/AR DEVIATION CURRENT meter. (Balanced condition.) *j.* Repeat steps 1*b*, *c*, and *d* above. (Agc control test at 100,000 μV output from AN/GRM-4.)	more than 140 microamperes. *g.* MK-428/AR DEVIATION CURRENT meter should indicate 0 microampere ±5. *h.* None. *i.* MK-428/AR DEVIATION CURRENT meter should indicate 0 microampere ±5. *j.* Total deflection current on MK-428/AR DEVIATION CURRENT meter should not be less than 90 microamperes or more than 130 microamperes.
3	As last indicated except: *AN/GRM-4* OUTPUT LEVEL: Adjust for 700 on UV dial. FREQUENCY: 335.0 DB TONE RATIO: 0 *MK-428/AR* CHANNEL: 3	N/A	*a.* Adjust AN/GRM-4 CARRIER ADJUST control until needle of CARRIER MONITOR meter is positioned at the redline. *b.* Adjust AN/GRM-4 MOD LEVEL control for percentage modulation recorded in 1*a* above. *c.* Repeat steps 1*b*, *c*, and *d* above. (Channel sensitivity test at 335.0 mc.) *d.* Repeat step 1*e* above.	*a.* None. *b.* None. *c.* Total deflection current on MK-428/AR DEVIATION CURRENT meter should be 160 microamperes ±2. *d.* MK-428/AR DEVIATION CURRENT meter should indicate 0 microampere ±3.

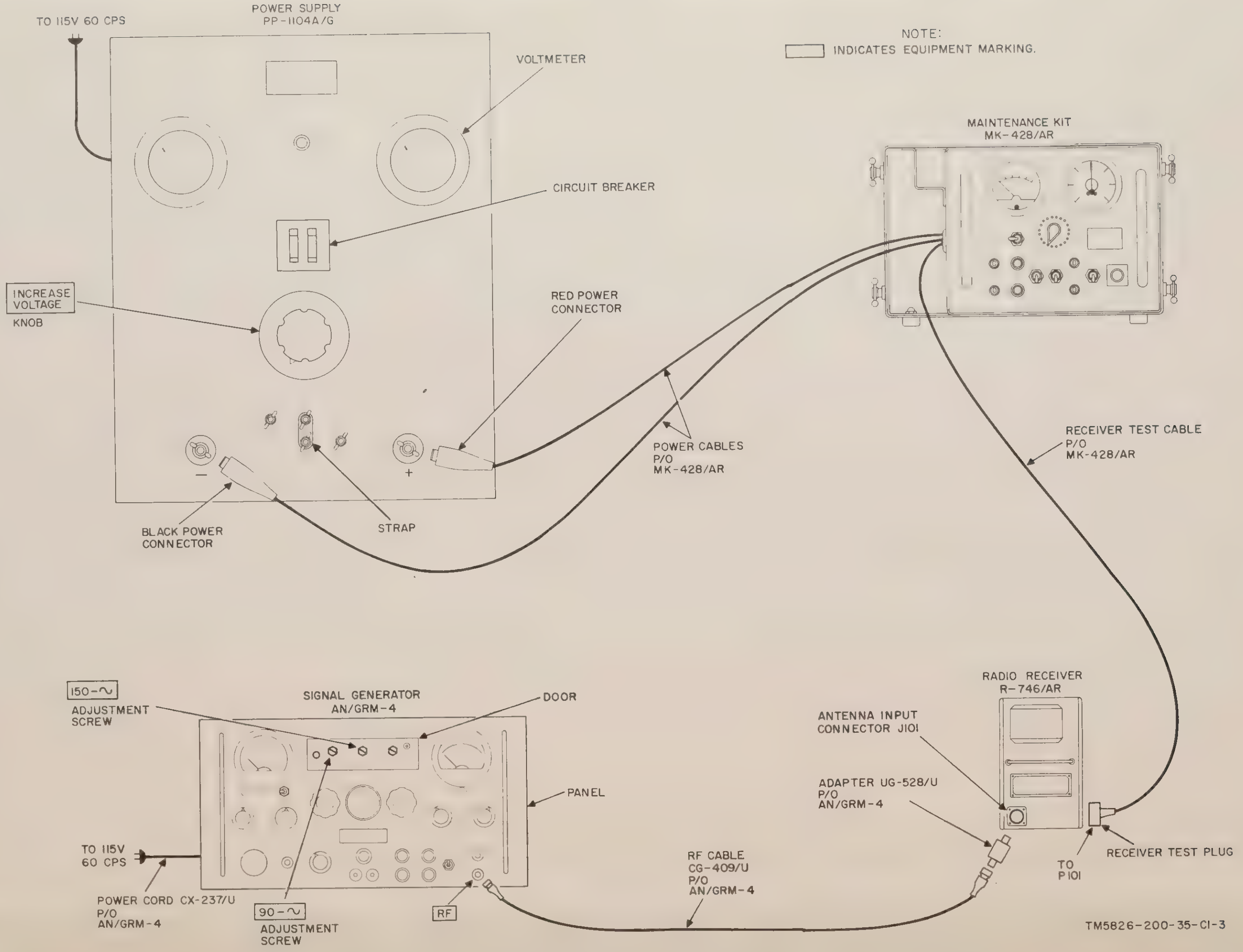
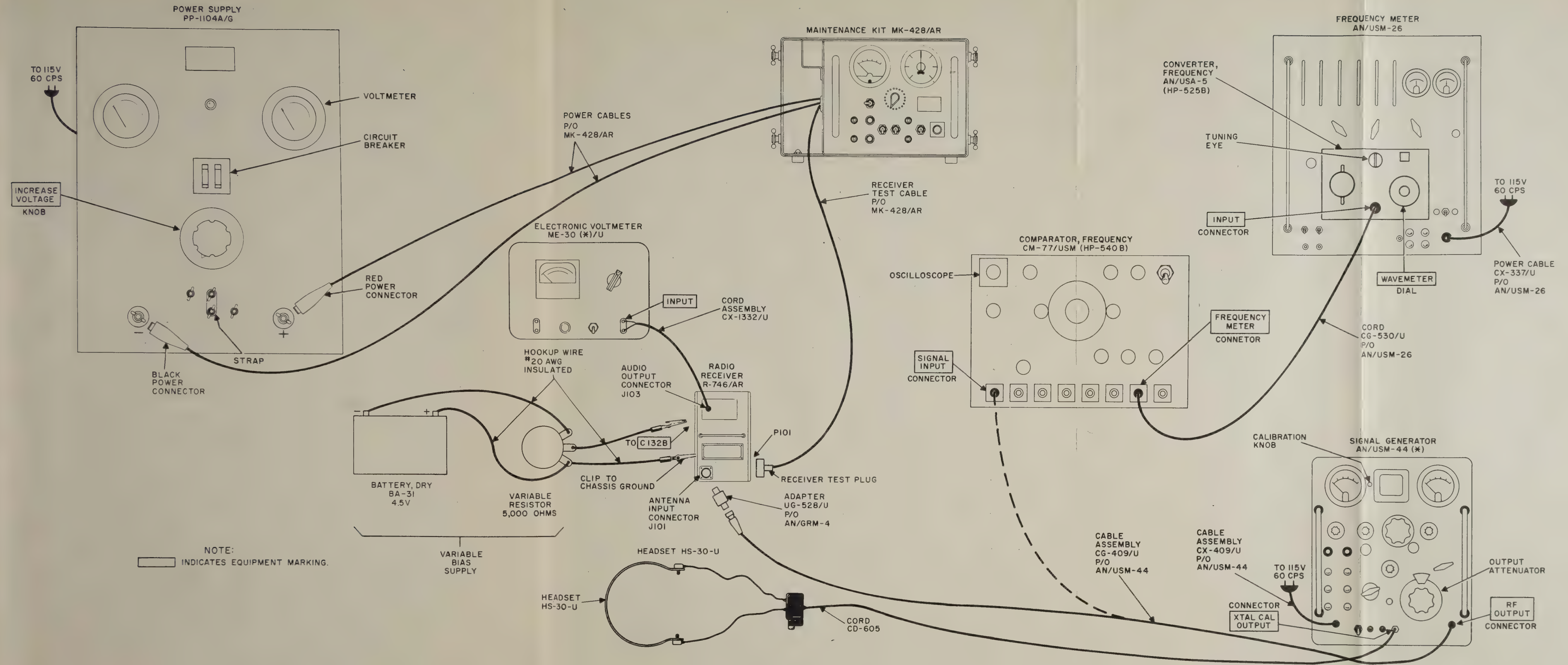

TO 115V 60 CPS
POWER SUPPLY PP-1104A/G
VOLTMETER
NOTE: ▭ INDICATES EQUIPMENT MARKING.
MAINTENANCE KIT MK-428/AR
CIRCUIT BREAKER
INCREASE VOLTAGE KNOB
RED POWER CONNECTOR
+
−
POWER CABLES P/O MK-428/AR
RECEIVER TEST CABLE P/O MK-428/AR
BLACK POWER CONNECTOR
STRAP
150-∿ ADJUSTMENT SCREW
SIGNAL GENERATOR AN/GRM-4
DOOR
RADIO RECEIVER R-746/AR
ANTENNA INPUT CONNECTOR J101
PANEL
ADAPTER UG-528/U P/O AN/GRM-4
TO 115V 60 CPS
RF CABLE CG-409/U P/O AN/GRM-4
TO P101
RECEIVER TEST PLUG
POWER CORD CX-237/U P/O AN/GRM-4
90-∿ ADJUSTMENT SCREW
RF
TM5826-200-35-C1-3

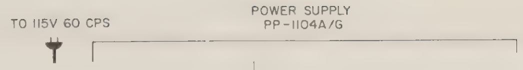
Figure 33.2. (Added) ***Primary voltage, agc, and sensitivity test connections.***



TM5826-200-35-C1-4

Figure 33.3. (Added) *Audio output, selectivity, resonance, and rejection test connections.*

Figure 33.3



			e. Operate AN/GRM-4 DB TONE RATIO switch counterclockwise to 2.0. *f.* Rotate AN/GRM-4 OUTPUT LEVEL control fully counterclockwise. *g.* Slowly rotate AN/GRM-4 OUTPUT LEVEL control clockwise until MK-428/AR DEVIATION CURRENT meter indicates 70. Note and record indication of AN/GRM-4 OUTPUT LEVEL control. (Sensitivity test at 335.0 mc.)	*e.* None. *f.* None. *g.* AN/GRM-4 UV dial should indicate less than 30 microvolts.
4	As last indicated except: *AN/GRM-4* OUTPUT LEVEL: Adjust for 700 on UV dial. FREQUENCY: 329.6 DB TONE RATIO: 0 *MK-428/AR* CHANNEL: 5	N/A	a. Repeat steps 3*a* and *b* above. *b.* Repeat steps 1*b*, *c*, and *d* above. (Channel sensitivity test at 329.6 mc.) *c.* Repeat 1*e* above. *d.* Repeat steps 3*e*, *f*, and *g*. (Sensitivity test at 329.6 mc.) *e.* Multiply largest of three indications recorded in 2*d*, 3*g*, and 4*d* by 0.7. (Sensitivity test.)	a. None *b.* Total deflection current on MK-428/AR DEVIATION CURRENT meter should be 160 microamperes ±2. *c.* MK-428/AR DEVIATION CURRENT meter should indicate 0 microampere ±3. *d.* AN/GRM-4 UV dial should indicate less than 30 microvolts. *e.* Result should be less than smallest recorded indication.
5	As last indicated except: *AN/GRM-4* DB TONE RATIO: 0 OUTPUT LEVEL: Adjust for 700 on UV dial.	N/A	*a.* Repeat 1*b*, *c*, *d*, and *e* above; use the following MK-428/AR CHANNEL positions and AN/GRM-4 FREQUENCY settings for channel sensitivity tests: *Note.* Repeat 3*a* and *b* above whenever the frequency of the AN/GRM-4 is changed. *MK-428/AR CHANNEL* — *AN/GRM-4 FREQUENCY (MC)* 1 ---- 334.4 7 ---- 330.2 9 ---- 330.8 11 ---- 331.4 15 ---- 332.6 17 ---- 333.2 19 ---- 333.8 *b.* Operate MK-428/AR RECEIVER ON-STANDBY switch to STANDBY, disconnect AN/GRM-4, and proceed to	*a.* Total deflection current on MK-428/AR DEVIATION CURRENT meter for each frequency setting should be 160 microamperes ±2. MK-428/AR deviation CURRENT meter should indicate 0 microampere ±3 when DB TONE RATIO switch is set to 0. *b.* None.

45.8. Audio Output, Resonance, Selectivity, and Rejection Tests

a. Test Equipment and Materials.

(1) Maintenance Kit, Electronic Equipment MK–428/AR.
(2) Frequency Meter AN/USM–26.
(3) Converter, Frequency AN/USA–5 (HP–525B).
(4) Comparator, Frequency CM–77/USM (HP–540B).
(5) Signal Generator AN/USM–44(*).
(6) Electronic Voltmeter ME–30(*)/U.
(7) Power Supply PP–1104A/G.
(8) Adapter UG–528/U (6-db attenuator) (p/o AN/GRM–4).
(9) Cord Assembly CX–1332/U.
(10) Battery, Dry BA–31 (4.5 volts).
(11) Resistor, variable 5,000 ohms.
(12) Hookup wire #20 AWG insulated.
(13) Clip, electrical alligator (2 each).
(14) Headset HS–30–U.
(15) Cord CD–605 (used with HS–30–U).

b. Test Connections and Conditions: Fabricate the variable bias supply as shown in the illustration but do not connect it to the receiver at this time. Connect all other equipment as shown in figure 33.3.

c. Test Procedure.

Step No.	Test equipment control settings	Equipment under test controls settings	Test procedure	Performance standard
1	*PP–1104A/G* Circuit Breaker: ON INCREASE VOLTAGE: Adjust for 27.5 volts on voltmeter. *MK–428/AR* METER RANGE: 0–1MA CHANNEL: 13	N/A	*a.* Adjust controls of AN/USM–44(*) as follows: (1) Adjust AMP TRIMMER control for maximum indication on OUTPUT VOLTS-DBM meter. (2) Adjust OUTPUT LEVEL control until OUTPUT VOLTS meter indicates SET LEVEL. (3) Operate MOD SELECTOR switch	*a.* None.
	VOLTS.		(*)/U. (Intermediate frequency test.) *e.* Turn off all power and disconnect all equipment. Replace side panels and cover on receiver.	volts (2 on 0-to-3 scale). *e.* None.

45.7. Primary Voltage, Agc, and Sensitivity Tests

a. Test Equipment and Materials.

(1) Maintenance Kit, Electronic Equipment MK–428/AR.

(2) Signal Generator AN/GRM–4.

(3) Power Supply PP–1104A/G.

b. Test Connections and Conditions. Replace the right-side panel of the receiver and connect the equipment as shown in figure 33.2.

Note. Adapter UG–528/U is a 6-db attenuator.

c. Calibration of AN/GRM–4. Perform the procedures as indicated in paragraph 45.6c.

d. Test Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*PP–1104A/G* Circuit Breaker: ON INCREASE VOLTAGE: For 27.5 volts on voltmeter. *AN/GRM–4* DB TONE RATIO: 0 *MK–428/AR* METER RANGE: 0–1MA RECEIVER ON-STANDBY: ON.	N/A	*a.* Note and record indication of PERCENT MODULATION meter.	*a.* None.
			b. Operate AN/GRM–4 DB TONE RATIO switch counterclockwise to 2.0. Note and record indication of MK–428/AR DEVIATION CURRENT meter.	*b.* None.
			c. Operate AN/GRM–4 DB TONE RATIO switch clockwise to 2.0. Note and record indication of MK–428/AR DEVIATION CURRENT meter.	*c.* None.
			d. Add values obtained in *b* and *c* above. (Primary voltage 27.5 volts sensitivity, agc control, and channel sensitivity tests at 332.0 mc and 700 μv output from AN/GRM–4.)	*d.* Total deflection on MK–428/AR DEVIATION CURRENT meter should be 160 microamperes ±2.
			e. Operate AN/GRM–4 DB TONE RATIO switch to 0. Note and record indication of MK–428/AR DEVIATION CURRENT meter (balanced condition).	*e.* MK–428/AR DEVIATION CURRENT meter should indicate 0 microampere ±2.
			f. Rotate PP–1104A/G INCREASE VOLTAGE control counterclockwise until voltmeter indicates 24 volts.	*f.* None.
			g. Repeat steps *b*, *c*, and *d* above. (Primary voltage 24-volt sensitivity test.)	*g.* Total deflection current on MK–428/AR DEVIATION CURRENT meter should not be less than 110 microamperes.
			h. Repeat *e* above.	*h.* MK–428/AR DEVIATION CURRENT meter should indicate 0 microampere ±2.
			i. Rotate PP–1104A/G INCREASE VOLTAGE control clockwise until voltmeter indicates 27.5 volts.	*i.* None.
2	As last indicated except: *AN/GRM–4* OUTPUT LEVEL: Adjust for 30 on UV dial.	N/A	*a.* Note indication on MK–428/AR DEVIATION CURRENT METER.	*a.* MK–428/AR DEVIATION CURRENT meter should indicate 0 microampere ±5.
			b. Repeat steps 1*b*, *c* and *d* above. (Agc control test at 30 μv output from AN/GRM–4.)	*b.* Total deflection current on MK–428/AR DEVIATION CURRENT meter should not be less than 140 or more than 220 microamperes.
			c. Operate AN/GRM–4 DB TONE RATIO switch counterclockwise to 2.0.	*c.* None.
			d. Rotate AN/GRM–4 OUTPUT LEVEL control counterclockwise until MK–428/AR DEVIATION CURRENT meter indicates 70. Note and record indication on AN/GRM–4 UV (microvolts) dial control. (Sensitivity test at 332 mc.)	*d.* AN/GRM–4 UV dial should indicate less than 30 microvolts.
			e. Rotate AN/GRM–4 OUTPUT LEVEL control until μV dial indicates 14,000.	*e.* None.
			f. Repeat steps 1*b*, *c*, and *d* above. (Agc control test at 14,000 μV output from the AN/GRM–4.)	*f.* Total deflection current on MK–428/AR DEVIATION CURRENT meter should not be less than 110 microamperes or more than 140 microamperes.
			g. Repeat step 1*e* above.	*g.* MK–428/AR DEVIATION CURRENT meter should indicate 0 microampere ±5.
			h. Rotate AN/GRM–4 OUTPUT LEVEL control until μV dial indicates 0.1V.	*h.* None.
			i. Note and record indication on MK–428/AR DEVIATION CURRENT meter. (Balanced condition.)	*i.* MK–428/AR DEVIATION CURRENT meter should indicate 0 microampere ±5.
			j. Repeat steps 1*b*, *c*, and *d* above. (Agc control test at 100,000 μV output from AN/GRM–4.)	*j.* Total deflection current on MK–428/AR DEVIATION CURRENT meter should not be less than 90 microamperes or more than 130 microamperes.
3	As last indicated except: *AN/GRM–4* OUTPUT LEVEL: Adjust for 700 on UV dial. FREQUENCY: 335.0 DB TONE RATIO: 0 *MK–428/AR* CHANNEL: 3	N/A	*a.* Adjust AN/GRM–4 CARRIER ADJUST control until needle of CARRIER MONITOR meter is positioned at the redline.	*a.* None.
			b. Adjust AN/GRM–4 MOD LEVEL control for percentage modulation recorded in 1*a* above.	*b.* None.
			c. Repeat steps 1*b*, *c*, and *d* above. (Channel sensitivity test at 335.0 mc.)	*c.* Total deflection current on MK–428/AR DEVIATION CURRENT meter should be 160 microamperes ±2.
			d. Repeat step 1*e* above.	*d.* MK–428/AR DEVIATION CURRENT meter should indicate 0 microampere ±3.
			e. Operate AN/GRM–4 DB TONE RATIO switch counterclockwise to 2.0.	*e.* None.
			f. Rotate AN/GRM 4 OUTPUT LEVEL control fully counterclockwise.	*f.* None.
			g. Slowly rotate AN/GRM–4 OUTPUT LEVEL control clockwise until MK–428/AR DEVIATION CURRENT meter indicates 70. Note and record indication of AN/GRM–4 OUTPUT LEVEL control. (Sensitivity test at 335.0 mc.)	*g.* AN/GRM–4 UV dial should indicate less than 30 microvolts.
4	As last indicated except: *AN/GRM–4* OUTPUT LEVEL: Adjust for 700 on UV dial. FREQUENCY: 329.6 DB TONE RATIO: 0 *MK–428/AR* CHANNEL: 5	N/A	a. Repeat steps 3*a* and *b* above.	a. None
			b. Repeat steps 1*b*, *c*, and *d* above. (Channel sensitivity test at 329.6 mc.)	*b.* Total deflection current on MK–428/AR DEVIATION CURRENT meter should be 160 microamperes ±2.
			c. Repeat 1*e* above.	*c.* MK–428/AR DEVIATION CURRENT meter should indicate 0 microampere ±3.
			d. Repeat steps 3*e*, *f*, and *g*. (Sensitivity test at 329.6 mc.)	*d.* AN/GRM–4 UV dial should indicate less than 30 microvolts.
			e. Multiply largest of three indications recorded in 2*d*, 3*g*, and 4*d* by 0.7. (Sensitivity test.)	*e.* Result should be less than smallest recorded indication.
5	As last indicated except: *AN/GRM–4* DB TONE RATIO: 0 OUTPUT LEVEL: Adjust for 700 on UV dial.	N/A	*a.* Repeat 1*b*, *c*, *d*, and *e* above; use the following MK–428/AR CHANNEL positions and AN/GRM–4 FREQUENCY settings for channel sensitivity tests: *Note.* Repeat 3*a* and *b* above whenever the frequency of the AN/GRM–4 is changed. *MK–428/AR CHANNEL* — *AN/GRM–4 FREQUENCY (MC)* 1 ---- 334.4 7 ---- 330.2 9 ---- 330.8 11 ---- 331.4 15 ---- 332.6 17 ---- 333.2 19 ---- 333.8	*a.* Total deflection current on MK–428/AR DEVIATION CURRENT meter for each frequency setting should be 160 microamperes ±2. MK–428/AR deviation CURRENT meter should indicate 0 microampere ±3 when DB TONE RATIO switch is set to 0.
			b. Operate MK–428/AR RECEIVER ON-STANDBY switch to STANDBY, disconnect AN/GRM–4, and proceed to next test	*b.* None.

45.8. Audio Output, Resonance, Selectivity, and Rejection Tests

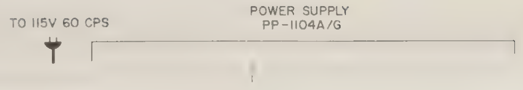
a. Test Equipment and Materials.

(1) Maintenance Kit, Electronic Equipment MK–428/AR.
(2) Frequency Meter AN/USM–26.
(3) Converter, Frequency AN/USA–5 (HP–525B).
(4) Comparator, Frequency CM–77/USM (HP–540B).
(5) Signal Generator AN/USM–44(*).
(6) Electronic Voltmeter ME–30(*)/U.
(7) Power Supply PP–1104A/G.
(8) Adapter UG–528/U (6-db attenuator) (p/o AN/GRM–4).
(9) Cord Assembly CX–1332/U.
(10) Battery, Dry BA–31 (4.5 volts).
(11) Resistor, variable 5,000 ohms.
(12) Hookup wire #20 AWG insulated.
(13) Clip, electrical alligator (2 each).
(14) Headset HS–30–U.
(15) Cord CD–605 (used with HS–30–U).

b. Test Connections and Conditions. Fabricate the variable bias supply as shown in the illustration but do not connect it to the receiver at this time. Connect all other equipment as shown in figure 33.3.

c. Test Procedure.

Step No	Test equipment control settings	Equipment under test controls settings	Test procedure	Performance standard
1	*PP–1104A/G* Circuit Breaker: ON INCREASE VOLTAGE: Adjust for 27.5 volts on voltmeter *MK–428/AR* METER RANGE: 0–1MA CHANNEL: 13 INT LOAD-EXT LOAD: INT LOAD POWER ON-OFF: ON RECEIVER ON-STANDBY: STANDBY *AN/USM–44* FREQUENCY RANGE: E FREQ. CONTROL: 332 FINE FREQ ADJUST: To index marker (dot). MOD SELECTOR: CW MOD LEVEL: Fully counterclockwise. Output Attenuator: 30 MICROVOLTS. 1MC–OFF–5MC: 5MC XTAL CAL GAIN: midposition OUTPUT LEVEL: ¾ of full clockwise rotation. AMP TRIMMER: Any position. Power: ON *ME–30(*)/U* DB VOLTS-VOLTS DB switch: 100 ON–OFF: ON *CM–77/USM* POWER: ON *Note.* Remaining controls may be in any position. *AN/USM–26* POWER ON: ON *Note.* Remaining controls may be in any position.	N/A	*a.* Adjust controls of AN/USM–44(*) as follows: (1) Adjust AMP TRIMMER control for maximum indication on OUTPUT VOLTS-DBM meter. (2) Adjust OUTPUT LEVEL control until OUTPUT VOLTS meter indicates SET LEVEL. (3) Operate MOD SELECTOR switch to 400. ~ (4) Rotate MOD LEVEL control clockwise until PER CENT MODULATION meter indicates 40. *b.* Operate MK–428/AR RECEIVER ON-STANDBY switch to ON. *c.* Carefully adjust AN/USM–44(*) FREQ control for maximum indication on ME–30(*)/U. *d.* Note and record indication on ME–30(*)/U. (Audio OUTPUT test.) *e.* Operate MK–428/AR RECEIVER ON-STANDBY switch to STANDBY.	*a.* None. *b.* None. *c.* None. *d.* ME–30(*)/U should not indicate less than 25 volts. (.25 on 0-to-1.0 scale.) *e.* None.
2	As last indicated except: *ME–30(*)/U* DB VOLTS-VOLTS DB switch: 30. *CM–77/USM* FOCUS INTENSITY: Midposition. HORIZ GAIN: Midposition COURSE VERNIER: Adjust for 166 on FREQUENCY MEGACYCLES dial. FINE VERNIER: adjust for 166 on FREQUENCY MEGACYCLES dial. *Note.* Remaining controls may be in any position. *AN/USM–26* MANUAL GATE: CLOSED 100KC STANDARD INT-EXT: EXT. STD. FREQ. COUNTED: 10MC. FUNCTION SELECTOR: FREQUENCY. STD GATE TIME SEC: 1 DISPLAY TIME: INF *AN/USA–5* MIXER-DIRECT-WAVEMETER switch: WAVEMETER. WAVEMETER dial: 160 MIXING FREQUENCY MC: 160.	N/A	*a.* Connect variable bias supply to C132B on R–746/AR as shown in figure 33.3. *b.* Operate MK–428/AR RECEIVER ON-STANDBY switch to ON. *c.* Adjust variable bias supply until ME–30(*)/U indicates 20 volts (2 on 0-to-3 scale). *d.* Set AN/USM–44(*) output attenuator to 60 microvolts. *e.* Rotate AN/USM–44(*) FREQ. control clockwise until ME–30(*)/U again indicates 20 volts. (2 on 0-to-3 scale). *f.* Remove CG–409/U cable assembly from UG–528/U adapter and connect it to CM–77/USM SIGNAL INPUT connector. *g.* Measure frequency of AN/USM–44(*) as follows: (1) Carefully adjust CM–77/USM COURSE VERNIER control until pattern is observed on oscilloscope screen. (2) Carefully adjust CM–77/USM FINE VERNIER control until oscilloscope pattern is reduced to straight horizontal line. *Note.* It is not necessary to maintain straight line display. After straight line has been obtained, adjustment is considered accurate. (3) Carefully adjust AN/USA–5 WAVEMETER dial for closure of tuning eye. (4) Operate AN/USA–5 MIXER-DIRECT-WAVEMETER switch to MIXER. (5) Operate AN/USM–26 100KC STANDARD switch to INT. *h.* Press AN/USM–26 RESET button. Note and record AN/USM–26 display. *i.* Remove CG–409/U from CM–77/USM SIGNAL INPUT connector and connect to UG–528/U. *j.* Rotate AN/USM–44(*) FREQ. control counterclockwise until ME–30(*)/U again indicates 20 volts (2 on 0-to-3 scale). *k.* Repeat 2*f*, *g* and *h* above. *l.* Add recorded indications in *h* and *k* above and divide sum by 2 (resonance test). *m.* Subtract recorded indication in *h* above from that of *k* above (6-db bandwidth).	*a.* None. *b.* None. *c.* None. *d.* None. *e.* None. *f.* None. *g.* None. *h.* None. *i.* None. *j.* None. *k.* None. *l.* Total of indications on AN/USM–26 should not be less than 5985.000 or more than 6015.000. *m.* The difference between the two recorded indications on the AN/USM–26 should be greater than 62.5 KC.
3	As last indicated except: *AN/USM–44(*)* Output Attenuator: 30 MILLIVOLTS.	N/A	*a.* Remove CG–409/U from CM–77/USM SIGNAL INPUT connector and connect it to UG–528/U. *b.* Rotate AN/USM–44(*) FREQ. control counterclockwise until ME–30(*)/U again indicates 20 volts (2 on 0-to-3 scale). *c.* Repeat 2*f*, *g*, *h*, and *i* above. *d.* Rotate AN/USM–44(*) FREQ. control clockwise until ME–30(*)/U again indicates 20 volts (2 on 0-to-3 scale). *e.* Repeat 2*f*, *g*, *h*, and *i* above. *f.* Subtract recorded indication in *c* and *e* above (60-db bandwidth).	*a.* None. *b.* None. *c.* None. *d.* None. *e.* None. *f.* Difference between two recorded indications on AN/USM–26 should not be greater than 250KC.
4	As last indicated except: *AN/USM–44(*)* Output Attenuator: 170 MILLIVOLTS.	N/A	*a.* Rotate AN/USM–44(*) FREQ. control clockwise until ME–30(*)/U again indicates 20 volts (2 on 0-to-3 scale). *b.* Repeat steps 2*f*, *g*, *h*, and *i* above. *c.* Rotate AN/USM–44(*) FREQ. control counterclockwise until ME–30(*)/U again indicates 20 volts (2 on 0-to-3 scale.) *d.* Repeat 2*f*, *g*, *h*, and *i* above. *e.* Subtract recorded indication in *c* and *d* above (75-db bandwidth). *f.* Remove the bias supply alligator clip from C132B on the R–746/AR.	*a.* None. *b.* None. *c.* None. *d.* None. *e.* Difference between two recorded indications on AN/USM–26 should not be greater than 300KC. *f.* None.
5	As last indicated except: *AN/USM–44(*)* FREQ. control: 232.6. Output Attenuator: 30 MILLIVOLTS. *MK–428/AR* CHANNEL: 15	N/A	*a.* Carefully adjust AN/USM–44(*) FREQ. control for maximum indication on ME–30(*)/U. *b.* Connect bias supply alligator clip to C132B on R–746/AR. *c.* Adjust variable bias supply until ME–30(*)/U indicates 20 volts (2 on 0-to-3 scale). *d.* Operate MK–428/AR CHANNEL switch to 13. *e.* Set AN/USM–44(*) OUTPUT attenuator to 95 MILLIVOLTS. *f.* Note and record indication of ME–30(*)/U. (Adjacent channel test.)	*a.* None. *b.* None. *c.* None. *d.* None. *e.* None. *f.* ME–30(*)/U should indicate less than 20 volts (2 on 0-to-3 scale).
6	As last indicated except: *AN/USM–44(*)* FREQ. control: 295.0 Output Attenuator: 170 MILLIVOLTS.	N/A	*a.* Calibrate AN/USM–44(*) as follows: (1) While listening for audible beat note in headset HS–30–U, carefully adjust FREQ. control until note disappears. (2) Check zero beat by rotating FREQ. control clockwise and counterclockwise. Tone should be heard on either side of proper setting. (3) Adjust calibration knob located at left of MEGACYCLES window to precisely position MEGACYCLES hairline over 295.0 graduation. *b.* Rotate AN/USM–44(*) FREQ. control to 294.2. *c.* Adjust AN/USM–44(*) AMP TRIMMER for maximum indication on OUTPUT VOLTS-DBM meter. *d.* Adjust AN/USM–44(*) MOD LEVEL control until PERCENT MODULATION meter indicates 40. *e.* Adjust AN/USM–44(*) OUTPUT LEVEL control until OUTPUT VOLTS-DBM meter indicates SET LEVEL. *f.* Note and record indication on ME–30(*)/U. (Image frequency test.)	*a.* None. *b.* None. *c.* None. *d.* None. *e.* None. *f.* ME–30(*)/U should indicate less than 20 volts (2 on 0-to-3 scale).
7	As last indicated except: *AN/USM–44(*)* FREQUENCY RANGE: A FREQ. control: 20 Output attenuator: 500 MILLIVOLTS.	N/A	*a.* Calibrate AN/USM–44(*) at 20MC; use procedure in 6*a* above. *b.* Rotate AN/USM–44(*) FREQ. control to 18.9 MC. *c.* Repeat 6*c*, *d*, and *e* above. *d.* Note and record indication on ME–30(*)/U. (Intermediate frequency test.) *e.* Turn off all power and disconnect all equipment. Replace side panels and cover on receiver.	*a.* None. *b.* None. *c.* None. *d.* ME–30(*)/U should indicate less than 20 volts (2 on 0-to-3 scale). *e.* None.



e. Operate AN/GRM-4 DB TONE NOTE: None

45.9. Summary of Performance Standards

Personnel may find it convenient to arrange the checklist in a manner similar to that shown below.

RECEIVER R–746/AR or R–746/AR

Test data	*Performance standard*
1. Balance, Audio, Deflection, and Flag Alarm Control Tests.	
a. Balance control range	Not less than 20 microamperes to the right of -0 and -20 microamperes to the left of 0 on MK–428/AR DEVIATION CURRENT meter.
b. Audio control range	Less than 75 microamperes to not less than 100 microamperes to the right of zero on the MK–428/AR DEVIATION CURRENT meter.
c. Deflection control range	80 microamperes to the left of zero, and less than 35 microamperes to the right of zero on MK–428/AR DEVIATION CURRENT meter.
d. Flag alarm control	Not less than 0.85 milliamperes on the MK–428/AR FLAG CURRENT meter.
2. Primary Voltage, Agc, and Sensitivity Tests	

Test data	*Performance standard*
a. Primary voltage	
(1) 27.5 volts sensitivity	Total deflection of 160 microamperes ±2 on MK–428/AR DEVIATION CURRENT meter.
(2) 24 volts sensitivity	Total deflection not less than 110 microamperes on MK–428/AR DEVIATION CURRENT meter.
b. Agc control (at 332.0 megacycles)	

AN/GRM–4 output (microvolts)	*Total deflection current limits on MK–428/AR DEVIATION CURRENT meter (microamperes)*	*Balanced condition on MK–428/AR DEVIATION CURRENT meter (microamperes)*
700	160 ±2	0 ±2
30	140 −220	0 ±5
14,000	110 −140	0 ±5
100,000	90 −130	0 ±5

c. Sensitivity at middle, high, and low frequencies.

Test data	*Performance standard*
(1) At 332, 335, and 329.6 megacycles	Less than 30 microvolts (as indicated on AN/GRM–4 OUTPUT LEVEL control) applied through 6-db attenuator (less than 15 microvolts to receiver) for 70-microamperes deflection on MK–428/AR DEVIATION CURRENT meter.
(2) Largest of the three values in (1) above multiplied by 0.7.	Less than the smallest of the three values recorded in (1) above.
d. Channel sensitivity	
(1) At 332.0 megacycles and 700 microvolts	160 microamperes ±2 total deflection current on MK–428/AR DEVIATION CURRENT meter. Zero microamperes ±2 in balanced condition.
(2) At 335, 329.6, 334.4, 330.2, 300.8, 331.4, 332.6, 333.2, and 333.8 megacycles and 700 microvolts.	160 microamperes ±2 total deflection current on MK–428/AR DEVIATION CURRENT meter for each frequency setting. Zero microamperes ±3 in balanced condition.
3. Audio output, resonance, selectivity, and rejection tests.	
a. Audio output tests	Not less than 25 volts on the ME–30(*)/U meter for 30 microvolts output from AN/USM–44(*) applied through 6-db attenuator (15 microvolts input to receiver).
b. Resonance test	Not less than 5985.000 (kilocycles) or more than 6015.000 (kilocycles) on the AN/USM–26.
c. Selectivity tests	
(1) 6-db bandwidth	Greater than 62.5 kilocycles.
(2) 60-db bandwidth	Not greater than 250 kilocycles.
(3) 75-db bandwidth	Not greater than 300 kilocycles.
d. Rejection tests	
(1) Adjacent channel test	Less than 20 volts on the ME–30(*)/U.
(2) Image frequency test	Less than 20 volts on the ME–30(*)/U.
(3) Intermediate frequency test	Less than 20 volts on the ME–30(*)/U.

APPENDIX

REFERENCES
(Superseded)

DA Pamphlet 310–4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
TA 11–17	Signal Field Maintenance Shops.
TA 11–100 (11–17)	Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shops.
TA 11–101 (11–158)	Allowances of Signal Corps Expendable Supplies for Signal Depot Company.
TM 1–12R5–2ARN14–2	Handbook Maintenance Instructions: Radio Receiving Set AN/ARN–14 (Bendix Radio).
TM 11–520	Radio Receiving Set AN/ARN–30.
TM 11–5057	Frequency Meter AN/USM–26.
TM 11–5126	Power Supplies PP–1104A/G, and PP–1104B/G.
TM 11–5527	Multimeters TS–352/U, TS–352A/U, and TS–352B/U.
TM 11–5556	Signal Generator SG–13/ARN.
TM 11–5826–200–12	Operator's and Organizational Maintenance Manual: RECEIVER GROUP AN/ARA–54.
TM 11–5826–207–10	Operator's Manual: Radio Receiving Sets AN/ARN–30A, AN/ARN–30B, and AN/ARN–30C.
TM 11–5826–213–12	Operator's and Organizational Maintenance Manual: Maintenance Kit, Electronic Equipment MK–428/AR and Test Set Radio TS–1466/AR.
TM 11–6625–274–12	Operator's and Organizational Maintenance Manual: Test Sets, Electron Tube TV–7/U, TV–7A/U, TV–7B/U, and TV–7D/U.
TM 11–6625–316–12	Operator and Organizational Maintenance Manual: Test Sets, Electron Tube TV–2/U, TV–2A/U, TV–2B/U, and TV–2C/U.
TM 11–6625–320–12	Operator's and Organizational Maintenance Manual: Voltmeter, Meter ME–30A/U and Voltmeters, Electronic ME–30B/U and ME–30C/U.
TOE 11–158D	Signal Depot Company.

Figure 34 (foldout): Make the following changes:

In the upper right-hand section of the illustration, under RECT V114 6 X 4W, add: NOTE 5.

Add the following to the notes:

5. REFER TO FIGURE 34.1 FOR RECTIFIER CIRCUIT FOR RECEIVER, RADIO R–746A/AR.

In the upper right-hand section of the illustration, at unlabeled resistor in parallel with R160 THERMAL, label the unlabeled resistor: R159 680.

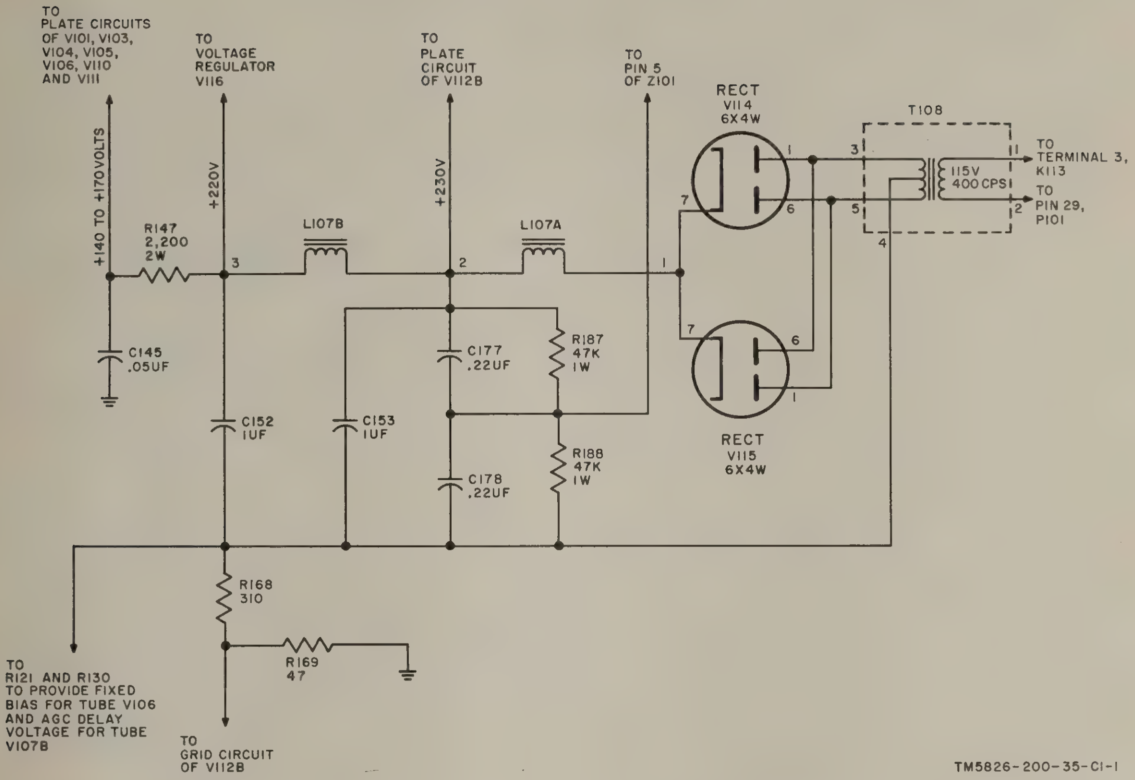


Figure 34.1. (Added) *Rectifier circuit for receiver, Radio R–746A/AR, schematic diagram.*

By Order of the Secretary of the Army:

G. H. DECKER,
General, United States Army,
Chief of Staff.

Official:
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The Adjutant General.

Distribution:

Active Army and USAR:

To be distributed in accordance with DA Form 12–31 requirements for field maintenance instructions for all fixed-wing aircraft.

NG: None.

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TECHNICAL MANUAL
No. 11-5826-200-35

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *13 May 1959*

RADIO RECEIVER R-746/AR

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CHAPTER 1

PREVENTIVE MAINTENANCE INSTRUCTIONS

Section I. PREFLIGHT AND POSTFLIGHT CHECK

1. Scope

a. This manual covers field and depot maintenance for Radio Receiver R–746/AR. It includes instructions appropriate to third, fourth, and fifth echelons for troubleshooting, testing, aligning, and repairing the equipment, replacing maintenance parts, and repairing specified maintenance parts. It also lists tools, materials, and test equipment for third, fourth, and fifth echelon maintenance. Detailed functions of the equipment are covered in the theory section.

b. The complete technical manual for this equipment includes one other publication:

TM 11–5826–200–12, Radio Receiver R–746/AR, Operation and Organizational Maintenance.

c. Forward comments concerning this manual to the Commanding Officer, United States Army Signal Publications Agency, Fort Monmouth, N.J.

Note. For applicable forms and records, see paragraph 2, TM 11–5826–200–12.

2. Inspection Schedule

Radio Receiver R–746/AR must be inspected periodically, usually at the same time the aircraft inspections are performed. The Electronic Navigation Equipment Repairman will perform preventive maintenance and the various operational and mechanical checks outlined in this section. The repairman will normally have access to a mobile repair truck or shop at third echelon or a fixed shop at fourth echelon. The operational checks given below require the use of an auxiliary power supply. The auxiliary power supply must be capable of delivering 27.5 volts at 1.1 amperes direct current (dc), and 115 volts at .25 ampere, 400 cycles alternating current (ac). For the flight line check, Signal Generator SG–13/ARN is used as a test set. Refer to TM 11–5556 for instructions on the use of the test set. Signal Generator SG–13/ARN is a portable test instrument used in determining the over-all operation of aircraft navigational and localizer receivers.

3. Mechanical Inspection

Examine the receiver antenna connector plug for tightness. Check the receiver mount for security. Check the security of the receiver in its mounting. Check for completeness and general condition of the receiving equipment.

4. Electrical Check

Turn receiver on (step 4 of par. 26*c*). Connect the Signal Generator SG–13/ARN to a suitable power source and proceed as follows:

a. Turn METER SW to LINE.

b. Turn SET LINE to 21V.

c. Turn NAV–GS SW to GS.

d. Turn AUDIO SELECTOR to 1000.

e. Allow 5 minutes for warmup.

f. Turn the MEGACYCLES control to a frequency that pairs with 332 megacycles (mc) (see chart inside signal generator cover).

g. Turn METER SW to CAR.

h. Turn CARRIER SET until meter reads on red line.

i. Attach the whip antenna (a part of Signal Generator SG–13/ARN).

j. Turn the AUDIO SELECTOR control to GLIDE SLOPE.

k. Turn the MICROVOLTS control to 1K.

l. Turn the LOC–GS knob back and forth and observe the glide slope pointer in the aircraft. The pointer should move up and down. The glide slope flag should not be seen.

5. Final Operational Checks

The following checks should be made as soon as practical after the aircraft has landed:

a. Check the aircraft forms for report of failures.

b. Make visual checks of equipment, cables, and cable connectors for possible damage.

c. Confirm the failure report on the aircraft forms with a preflight check.

6. Periodic Checks

a. 25-Hour Inspection.

(1) Inspect the antenna for corrosion and damage.

(2) Check all controls for positive action.

(3) Inspect wiring harnesses and cables for possible breaks, frayed insulation, kinks, and broken cording.

(4) See that all mounted components are secure.

(5) Perform a preflight check to determine overall operation of the equipment.

b. 100-Hour Inspection.

(1) Remove all major units (par. 42) to the repair shop.

(2) Remove dust covers from major units and inspect for loose connections, corrosion, and foreign matter.

(3) Check all tubes (par. 25) and replace weak or defective ones.

(4) Perform alignment checks (par. 44).

(5) Replace the equipment in the aircraft and reconnect plugs, connectors, and safety wire (par. 7).

(6) Perform the 25-hour inspection.

(7) Complete inspection forms.

Section II. REMOVAL AND REPLACEMENT INSTRUCTIONS

7. Removal and Replacement of Radio Receiver R–746/AR

a. Removal.

(1) Remove the safety wire that holds the thumbscrew in place (fig. 1).

(2) Disconnect the receiver from the mounting by loosening the thumbscrew (fig. 1) on the front of the mounting.

(3) Continue turning the thumbscrew counterclockwise until the rear connector is disconnected.

(4) Remove the unit from the mounting by sliding the receiver forward along the protruding metal flange.

b. Replacement.

(1) Set the receiver between the flanges on the mounting; push it back as far as possible by hand (fig. 2).

(2) Fasten the receiver on the mounting by tightening the thumbscrew on the front of the mounting. The thumbscrew is hand-tightened only (fig. 1) and should not be forced. Use no tools.

(3) The angle plate on the front of the mounting holds the receiver on the mounting. This angle plate has a small hole for the use of safety wire, and the thumbscrew has two similar holes.

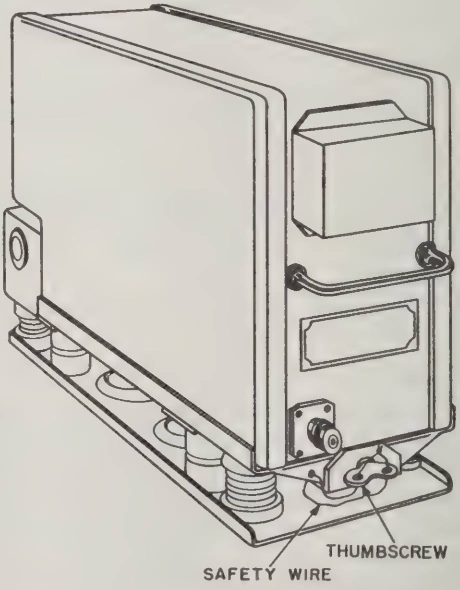


Figure 1. Method of connecting safety wire.

When the receiver has been satisfactorily mounted and the thumbscrew tightened, insert a piece of safety wire through the provided holes and wind the ends of the wire tightly together (fig. 1). This prevents accidental loosening of the thumbscrew.

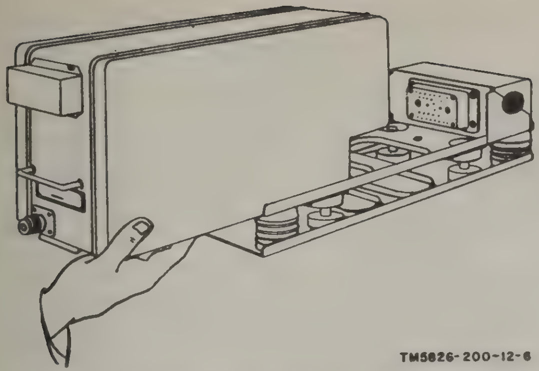
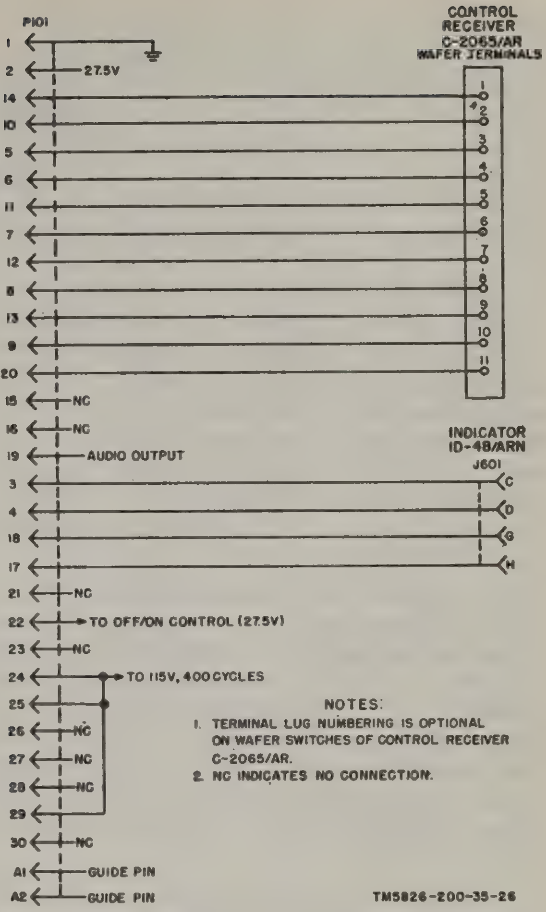


Figure 2. Removing Radio Receiver R–746/AR from Mounting MT–1762/AR.

8. Connections

The components of Radio Receiver R–746/AR are connected according to the cording diagram (fig. 3). Open wiring is used except in those places where metallic conduit shielding is needed for protection from extraneous noise. Shielded wire is used where specified in the systems diagram.



NOTES:
1. TERMINAL LUG NUMBERING IS OPTIONAL ON WAFER SWITCHES OF CONTROL RECEIVER C-2065/AR.
2. NC INDICATES NO CONNECTION.

Figure 3. Interconnecting wiring diagram.

Section III. PREVENTIVE MAINTENANCE

9. Maintenance Procedures

Periodic maintenance of Radio Receiver R–746/AR will include the operations listed in *a* through *g* below. Additional maintenance information will be found in the preventive maintenance portion of TM 11–5826–200–12, Radio Receiver R–726/AR, Operation and Organizational Maintenance.

***Warning:* When power to the equipment is disconnected, some capacitors still may retain voltage of dangerous potential. Before touching exposed electrical parts, short circuit the part to ground.**

a. Inspect seating of readily accessible pluck-out items, such as tubes, lamps, crystals, and connectors.

b. Remove the crystal relay subchassis cover and visually check the relay contacts. Look for burned and/or pitted electrodes. Check for misalignment of contacts and insufficient spring tension.

c. Inspect resistors and insulators for cracks, shipping, blistering, moisture, and discoloration.

d. Carefully check filter capacitors C153 and C152 (fig. 27) for leakage or corrosion.

e. Carefully check power transformer T108 and filter choke L107 (fig. 27) for any sign of overheating or oil leakage.

f. Check the receiver for normal operation.

10. Lubrication

No lubrication of this equipment is required.

CHAPTER 2

THEORY

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11. General

Radio Receiver R–746/AR is a lightweight, 16-tube, airborne, superheterodyne receiver for the reception of glide slope information within a frequency range from 329.3 to 335.0 mc. The receiver has 20 fixed frequency channels. When used in conjunction with Indicator ID–48/ARN or Course Indicator ID–249A/ARN, the receiver produces vertical guidance during aircraft landing operations.

a. The glide slope portion of the standardized instrument approach system consists of a glide slope transmitter, which transmits a carrier frequency into the desired field pattern. In this pattern, a 150 cycle per second (cps), tone-modulated carrier frequency is radiated in the area below the path of the glide slope and a 90-cps, tone-modulated carrier of the same frequency is radiated in the area above the glide slope.

b. When the aircraft receiver is tuned to the carrier frequency of the glide slope transmitter, the 90-cps and 150-cps tone signals are detected, amplified, separated by filters and rectified into proportional dc potentials. These dc potentials are governed by the position of the aircraft with respect to the glide slope. The proportional dc voltage, due to the 90-cps signal, will predominate when the aircraft is above the glide slope. The difference between the dc potentials due to the 90-cps and 150-cps modulation frequencies will, when applied to the coil of the glide slope pointer in the cross-pointer indicator, cause the pointer to deflect downward when the 90-cps tone predominates and upward when the 150-cps tone predominates. The pointer will remain in its normal rest position when the dc voltages proportional to the 90-cps and 150-cps signals are equal, indicating the aircraft is on the glide slope.

c. Radio Receiver R–746/AR is capable of receiving any one of 20 carrier frequencies with 300-kilocycles (kc) separation in the band of 329.3 to 335.0 mc. The operating frequency of the receiver is controlled through the use of crystal selector relays. These relays may be operated from a standardized remote control unit in the aircraft. This control unit selects the correct glide slope frequency simultaneously as the desired localizer frequency is set up in the remote control.

d. All functions of the receiver are remotely controlled. Internal variable adjustments are kept to a minimum consistent with accurate performance under varying operating conditions. The control panel incorporates a concentric knob-type frequency seelctor calibrated directly in frequency. Simultaneous control of the glide slope receiver, navigational receiver (localizer, omnirange, and communications), and the interrogator is provided by the control panel. The glide slope receiving channel is set up automatically when the corresponding localizer channel frequency is selected on the control panel.

12. Block Diagram

The relationship between the stages of the receiver and the various frequencies in it is shown in the block diagram (fig. 5). For complete circuit details, refer to the overall schematic diagram (fig. 34). The receiver is of the fixed tuned, superheterodyne type. The radio frequency (RF) amplifier and the oscillator-multiplier circuits are broadly tuned to the approximate center channel frequency. To provide operation on the desired channel, it is only necessary to select the proper oscillator crystal. One of 20 crystals from the crystal relay bank is selected by operating the relays to facilitate remote channel changing. The crystals cover a frequency range of 11.496296 to 11.707407 megacycles per second (mcs). The frequency output of oscillator tripler V111 is 27 times the crystal frequency and is 18.9 mc below the desired channel frequency.

a. Antenna MN–92A or MN–92B (fig. 4) functions as the receiving antenna for Radio Receiver R–746/AR. The physical structure of the antenna is such that it may be mounted flush with the skin of the aircraft. The opening of the antenna is covered with plexiglas. Normally the antenna will be mounted in the nose of the ship and facing forward. The mounting angle is not critical although the perpendicular plane of the antena should not be more than +15° or —20° from the horizontal axis of the aircraft. The MN–92A is supplied with a 90° coaxial fitting on the side of its housing. The MN–92B is provided with a straight fitting. The antenna assembly comprises four parallel conductors (rods) mounted in a brass housing or cavity. The four rods function similarly to an antenna array, which picks up the signal from the electric field set up within the box by the oncoming radio wave. Each of the rods is supported at one end of a micarta insulator. The insulator is fastened to one side of the box. The other end of each rod is fastened to a common conductor of the coaxial fitting. The conductors are fashioned from ⅛-inch brass tubing. The entire assembly is silver-plated.

b. RF amplifier V101 improves image frequency rejection and, at the same time, isolates the receiver oscillator circuits from the antenna. The desired signal voltage from the antenna is amplified by RF amplifier V101. The output of RF amplifier V101 is transformer-coupled to the grid of the mixer stage V102. The heterodyning signal for the mixer is supplied from crystal oscillator circuits V109, V110, and V111. The mixer stage develops a 18.9-mc intermediate frequency (IF). Output from the mixer is supplied to the IF amplifier stages.

c. Four IF stages are used in the receiver to provide the necessary signal gain and adjacent channel selectivity. The 18.9-mc output of mixer V102 is coupled to the grid of first IF amplifier V103. Additional amplification is provided by second IF amplifier V104, third IF amplifier V105, and output IF amplifier V106.

d. The output signal of fourth IF amplifier V106 is coupled to detector stage V107A. The audio output of the detector is coupled through a low-pass (noise) filter to first audio amplifier V112A. The amplified output of V112A is coupled to the output of audio frequency (AF) amplifier V112B. The dc output of the detector is applied between the grid and cathode of automatic gain control (agc) amplifier V108A. The

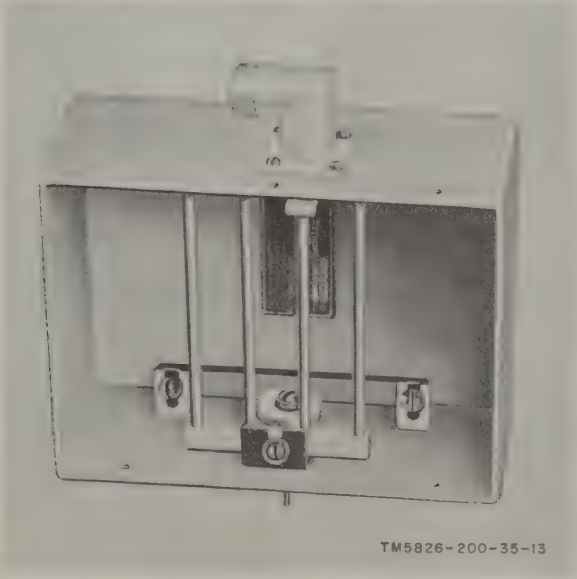


Figure 4. Tuned cavity type of glide slope antenna.

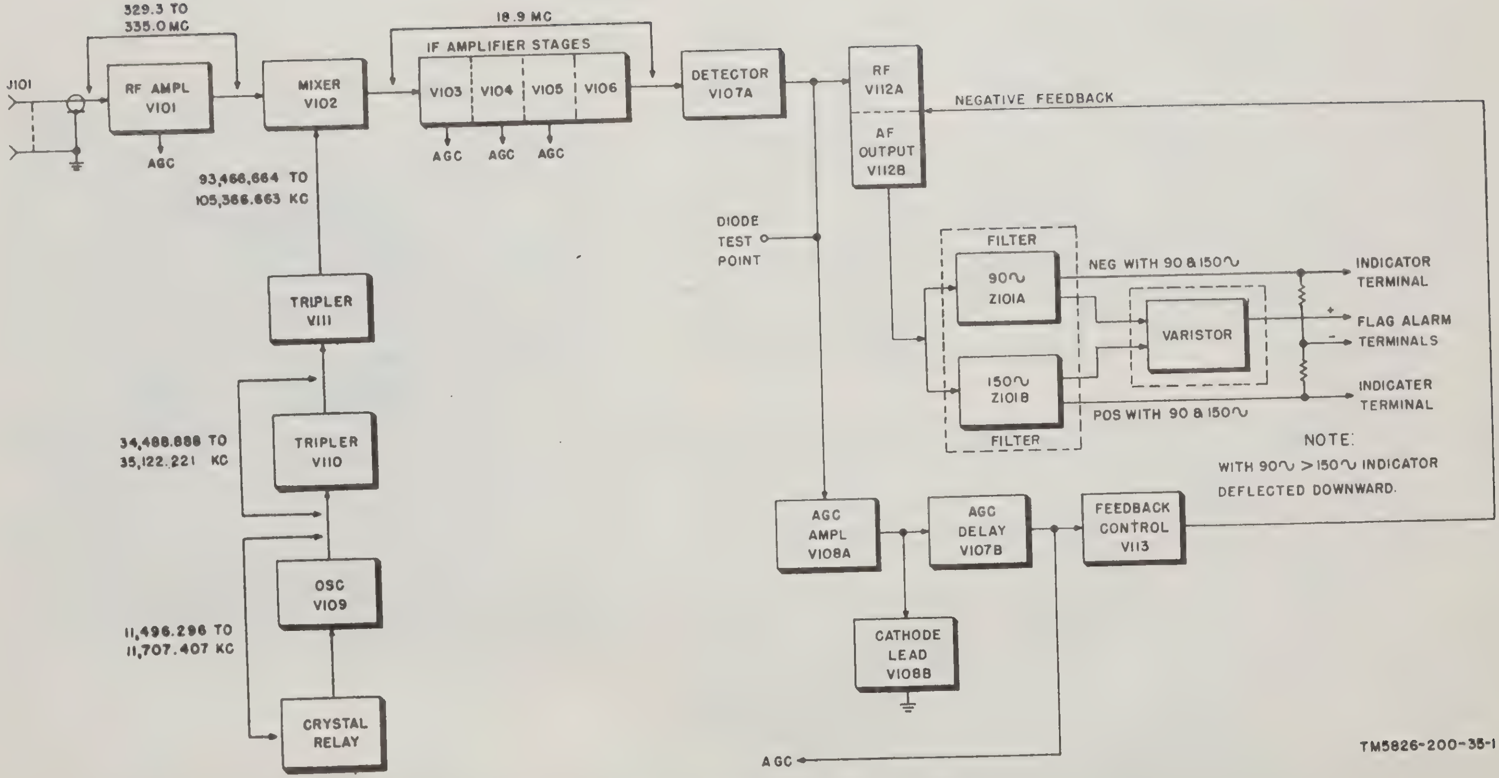
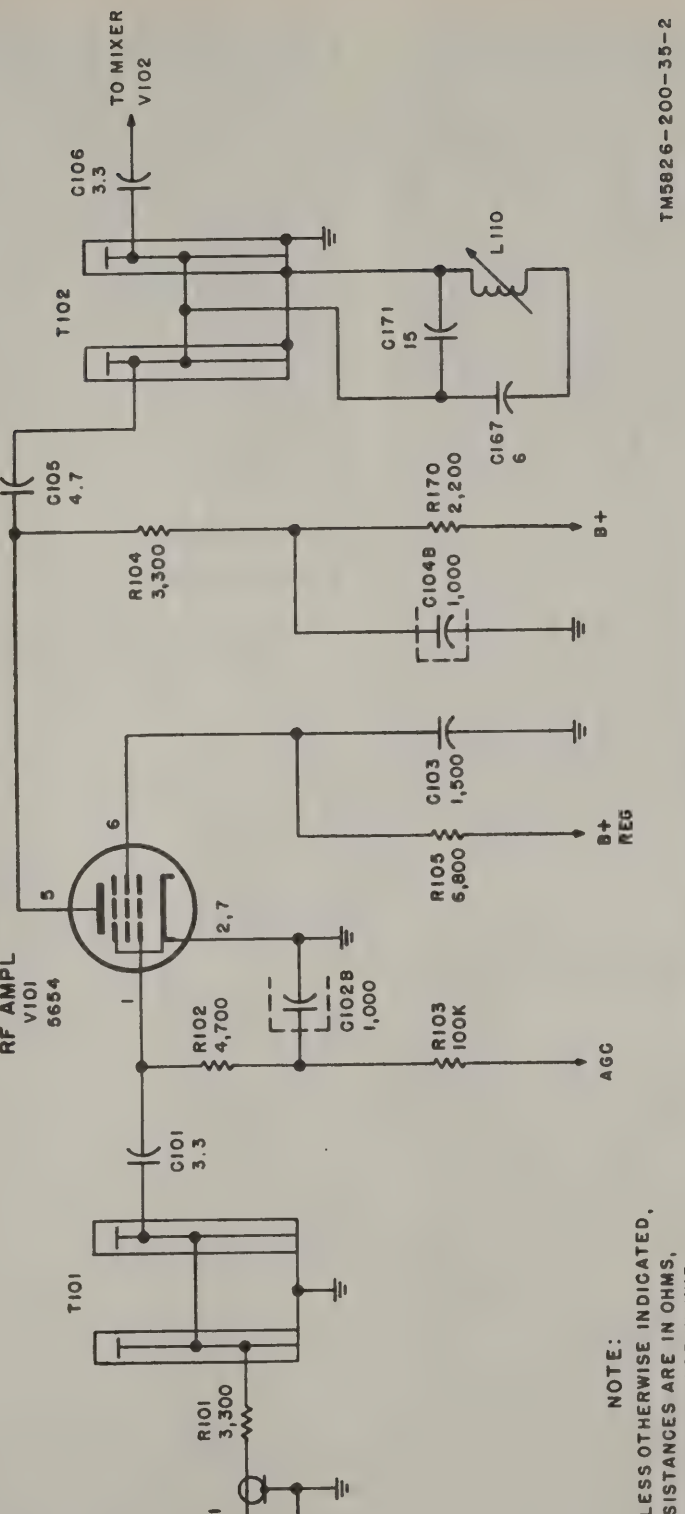


Figure 5. Radio Receiver R–746/AR, block diagram.



NOTE:
UNLESS OTHERWISE INDICATED,
RESISTANCES ARE IN OHMS,
CAPACITANCES ARE IN UUF

Figure 6. RF amplifier V101, schematic diagram.

agc amplifier keeps the rectified IF voltage at the detector output as constant as possible.

e. The output of AF amplifier V112B is coupled to band-pass filters Z101A and Z101B. These filters separate the modulation into the 90-cps and 150-cps components. These two tones are separately rectified by varistor CR101 and then applied to two separate meter movements for *course* and *on-off* indications. In one meter circuit, the rectified tones are subtracted and their difference is used to provide the information which enables the pilot to keep the aircraft on the glide slope approach to the landing field. In the other meter circuit, the rectified tones are added and their sum is used to provide the information for the flag alarm meter movement, which in turn provides the *on-off* information for the pilot.

f. The feed-back circuit uses a variable shunt resistance to reduce the gain of AF amplifier V112A with increasing signal strength. This is done to flatten the agc characteristic. The variable shunt resistance consists of pentode tube V113 connected as a triode with the grid controlled by a portion of the agc voltage. This arrangement increases the negative feedback of AF amplifier V112A and therefore provides less gain as the signal strength increases.

13. RF Amplifier V101
(fig. 6)

RF amplifier V101 uses a 5654 pentode to amplify the low-level signals developed in the antenna circuit.

a. The primary of transformer T101 is tapped by resistor R101 to provide the proper impedance match between the receiver input and the antenna. The receiver input is designed to match a 52-ohm transmission line. Transformers T101 and T102 are constructed of transmission line sections which are temperature compensated and provide a band pass approximately 6 megacycles wide. All parts of these transformers are maintained at dc ground potential by the use of small coupling capacitors. Agc voltage is applied through decoupling resistor R103 and grid return resistor R102. Screen potential is applied through R105, with C103 as the screen-grid bypass capacitor. Capacitor C104B decouples V101 plate circuit from the power supply. The primary of T102, which electrically functions as a parallel tank, serves as the plate load for V101.

b. Signals from the antenna circuit are coupled by T101 and C101 to the control grid (pin 1) of RF amplifier V101. The amplified signals that appear at the plate (pin 5) of the RF amplifier are coupled by T102 and C106 to the control grid of mixer V102. The grid and plate resistors and the coupling capacitors load transformers T101 and T102 for the desired band pass and tuning characteristics (fig. 7).

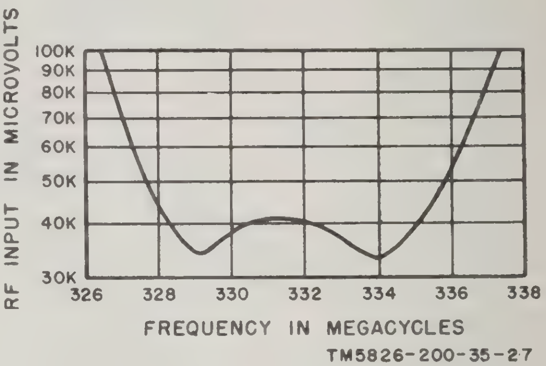


Figure 7. RF band-pass frequency response curve.

14. Mixer V102
(fig. 8)

The mixer stage is a miniature 5654 pentode. This stage heterodynes or mixes the incoming signal and the receiver oscillator signals to produce the desired IF of 18.9 mc.

a. The amplified signal voltage that appears across the secondary of T102 is coupled to the grid of V102 by dc blocking capacitor C106. Resistor R106, in series with R107, makes up the dc grid return. A test point is provided at the junction of R106 and R107. Capacitor C108B places this test point at RF ground. The signal frequency (329.3 to 335.0 mc) is converted to IF (18.9 mc) by combining it with the output of oscillator-multiplier circuits V109, V110, and V111. The signal frequency is applied to the control grid of the mixer, and the locally produced oscillator voltage is applied to the ungrounded side of the mixer cathode through capacitor C142. The oscillator frequency injected on the cathode of the mixer is 18.9 mc below the signal frequency and its potential is between 1 and 2 volts dc, measured at the mixer test point (junction of R106 and

R107) to ground. IF alinement connector J102 is coupled to the mixer signal grid through a small capacitor, C107. Resistor R108 shunts J102 to match the connector to a 50-ohm source. Comparatively high value screen-grid resistor R109 obtains maximum conversion transconductance. The screen is bypassed to ground by capacitor C174. The plate of tube V102 receives its operating potenial through plate decoupling resistor R110 and the primary winding of IF transformer T103. The primary and secondary of T103 are tuned to the 18.9-mc IF by adjustable cores. Capacitor C111 bypasses the plate circuit to ground.

b. The signal voltage from RF amplifier V101 is coupled by T102 and C106 to the control grid of the mixer. The injection signal from the crystal oscillator circuits is at a fixed frequency and is applied through C142 to the ungrounded side of the mixer cathode (pin 2). The coupling arrangement is designed to match the low-impedance cathode circuit of the mixer to the comparatively high output impedance of oscillator tripler V111 plate circuit. The mixer plate circuit is tuned to 18.9 mc by the powdered-iron cores of T103. The 18.9-mc IF signal from the plate of the mixer is transformer-coupled by T103 to the IF amplifier stages.

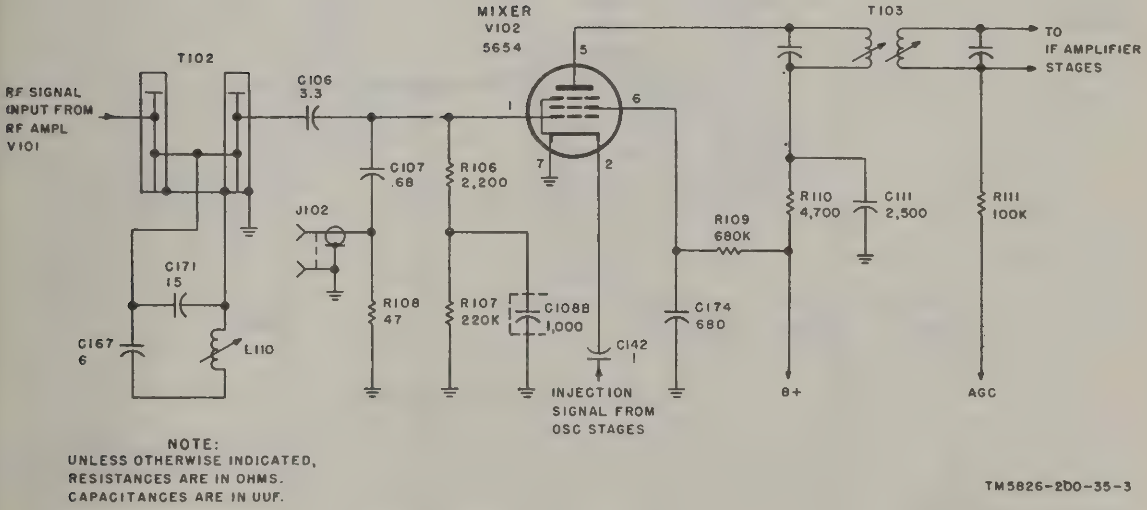


Figure 8. Mixer V102, schematic diagram.

15. Crystal Oscillator and Oscillator-Multiplier Stages

The crystal oscillator and oscillator-multiplier stages consist of 5654 tubes V109, V110, and V111. All associated tank circuits are broad band. The mixer (V102) injection frequency is 27 times the crystal frequency and is 18.9 mc below the desired channel frequency. The fundamental frequency covers a range of 11,496 to 11,707.407 kilocycles.

a. Crystal Oscillator (fig. 9). The circuit is capable of developing strong harmonics of the crystal frequency. The plate circuit of the oscillator is tuned to the third harmonic of the crystal frequency. A trap, consisting of coil L106 and capacitor C134, is used to series-resonate the cathode circuit to the third harmonic frequency so that the circuit will not oscillate due to coupling between that plate and suppressor-cathode. The cathode currents, at multiples of the crystal frequency, develop strong voltages across the cathode coil, which increases the output of the oscillator at harmonic frequencies. Resistor R172 is the screen-grid voltage dropping resistor and capacitor C137A is the screen-grid bypass capacitor. The plate voltage of tube V109 is applied through isolation resistor R137 and adjustable inductor L102. Capacitor C137B bypasses the plate voltage supply line to ground. The output of V109 is transformer-coupled by L102 and L103. These coils are coupled to form a band-pass characteristic for the third harmonic of the crystal frequency.

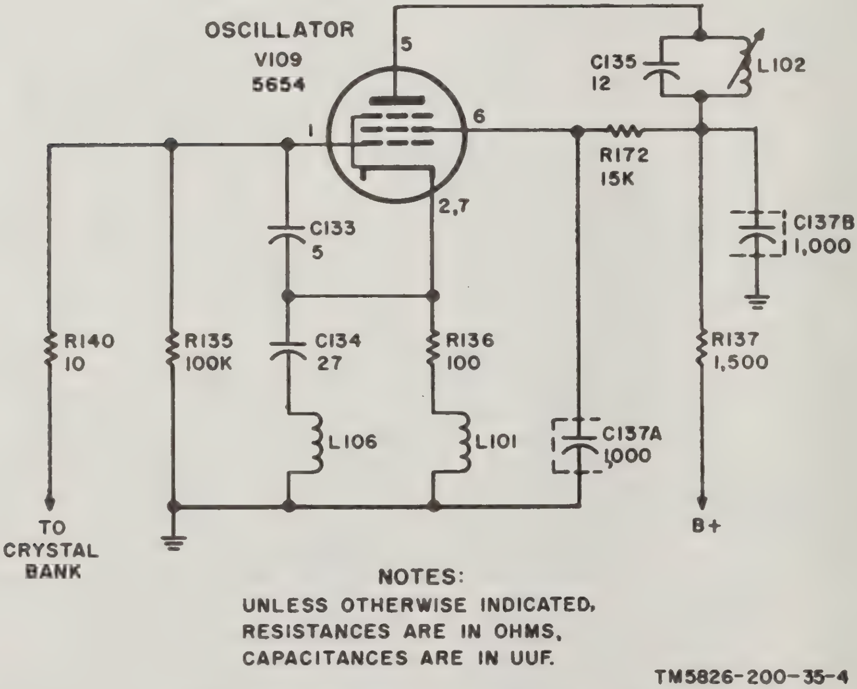
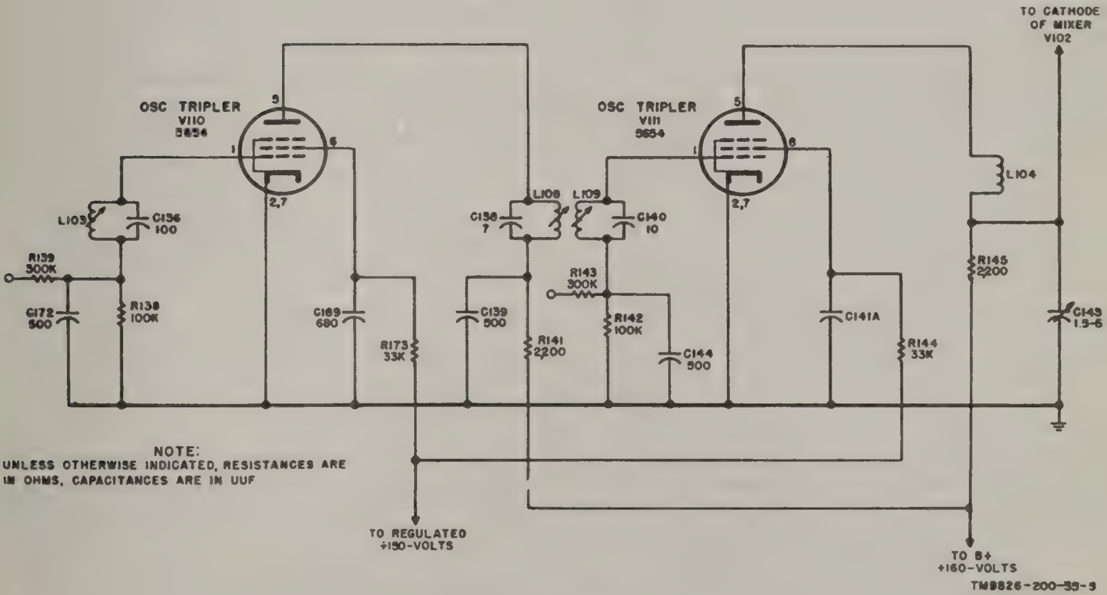


Figure 9. Crystal oscillator V109, schematic diagram.

b. Oscillator-Multipliers V110 and V111 (fig. 10). Oscillator-multiplier V110 again triples the frequency. The ninth harmonic of the fundamental crystal frequency is present in the plate circuit of V110 and is applied through coils L108 and L109 to the following stage. Resistor R138 and capacitor C172 make up the grid leak bias network for V110. Resistor R139 isolates the first tripler test point from the grid circuit. Resistor R173 is the screen-grid voltage dropping resistor and the screen grid is bypassed to ground by capacitor C169. The plate of V110 receives its operating potential through decoupling resistor R141 and inductor L108. Capacitor C139 bypasses the plate circuit to ground and completes the RF plate tuning circuit. Coils L108 and L109 are coupled to form a band pass for the ninth harmonic of the crystal frequencies. The desired harmonic voltage appearing across inductor L109 is coupled to the grid of final oscillating-multplier V111. The plate circuit of this tube is tuned to the 27th harmonic of the fundamental by coil L104 and capacitor C143. Resistor R142 and capacitor C144 make up the grid leak bias network for V111. Resistor R143 minimizes grid loading by the second tripler test point. Resistor R144 is the screen-grid voltage dropping resistor and the screen grid is bypassed to ground by capacitor C141A. The plate of V111 receives its operating potential through resistor R145 and inductor L104. The output of V111 is coupled by capacitor C142 to the ungrounded side of the mixer (V102) cathode.



NOTE:
UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF

TM9826-200-35-3

Figure 10. Oscillator-multipliers V110 and V111, schematic diagram.

c. Crystal Selection Unit (fig. 11). Twenty crystals are supplied from 11,496.296 to 11,707.407 kc. These crystals, with associated relays (K101 through K111), are inclosed on top of the receiver chassis. The plug-in crystals are arranged in four banks on two crystal socket boards, with two banks on each board. Ten pairs of crystals are associated with 10 double-pole, single-throw (dpst) relays (normally open). The bank of 10 crystals to be used at any given time is selected by a single-pole, double-throw (spdt) relay (K111). To select any one of the 20 crystal-controlled channels, it is only necessary to activate one of the dpst relays (K101 through K110) and use either the activated or normally closed contacts of the spdt relay. One side of the coils of each of the crystals selecting relays is connected in the receiver to the +26.5-volt dc line. Relays are actuated by grounding the other side of the coil.

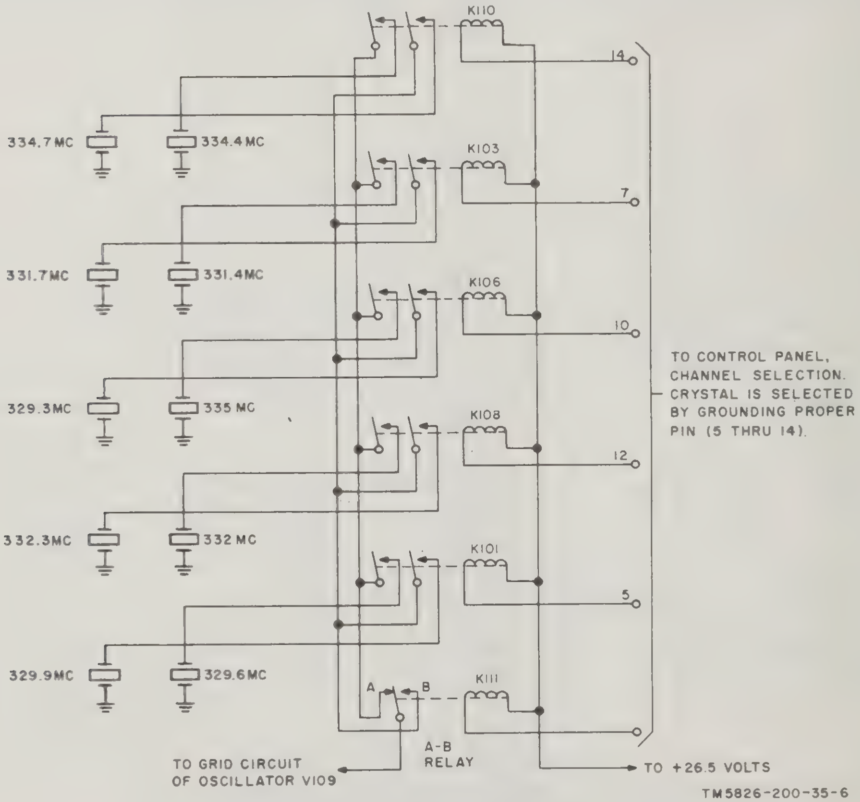


Figure 11. Crystal selection unit, simplified diagram.

16. IF Amplifiers V103, V104, V105, and V106

The IF amplifier system consists of four voltage amplifier stages, which use 5654 miniature pentode tubes V103, V104, V105, and V106. The IF transformers are temperature-stabilized units with capacitors of low temperature coefficient. At the center frequency, selectivity and gain of these units remain extremely stable with changes in temperature, humidity and altitude. The IF transformers include an iron core tuned primary and secondary circuits. Each primary and secondary coil is a solenoid with a displaced end turn used for constant coupling. The larger part of the winding is tuned by a powdered iron core. As the coupling coil is removed from the field of the larger winding, adjustment of the iron core has less effect on the coupling between the primary and secondary winding. Series voltage dropping resistors are used in the screen grid on these tubes to provide a slight amount of variable gain with variations in input signal amplitude (semiremote cutoff characteristic). This is required to obtain agc without modulation distortion.

a. First IF Amplifier V103. The first IF amplifier stage (fig. 12) uses a 5654 miniature pentode as a voltage amplifier of 18.9 mc signals.

(1) Agc voltage from the agc circuit (par. 17) is applied to the grid (pin 1) through decoupling resistor R111 and the secondary winding of IF transformer T103. Resistor R111 and capacitor C112A make up the grid decoupling filter. When the agc voltage is applied to the control grid, the gain of the stage is automatically controlled by the average signal strength (par. 17), and the suppressor grid is at ground potential. B+ is applied to the screen grid (pin 6) through voltage dropping resistor R112. Capacitor C149 bypasses RF voltages to ground. The plate (pin 5) circuit is completed to B+ through the primary of IF transformer T104, decoupling resistor R113, and decoupling trap Z103.

(2) The 18.9-mc signal from the plate circuit of the mixer (V102) is applied to the control grid of V103 (pin 1) through IF transformer T103. The amplified signal at the plate is coupled by IF transformer T104 to the control grid (pin 1) of second IF amplifier V104.

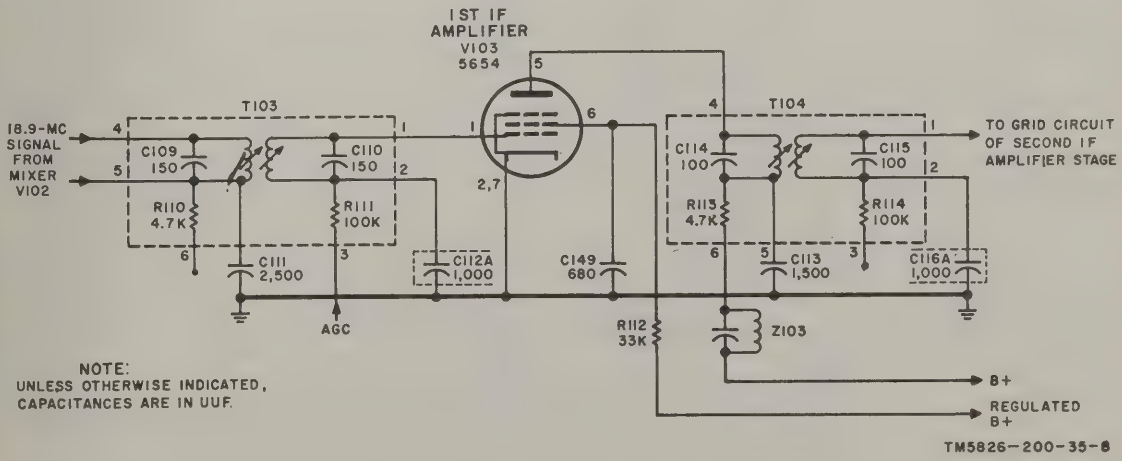
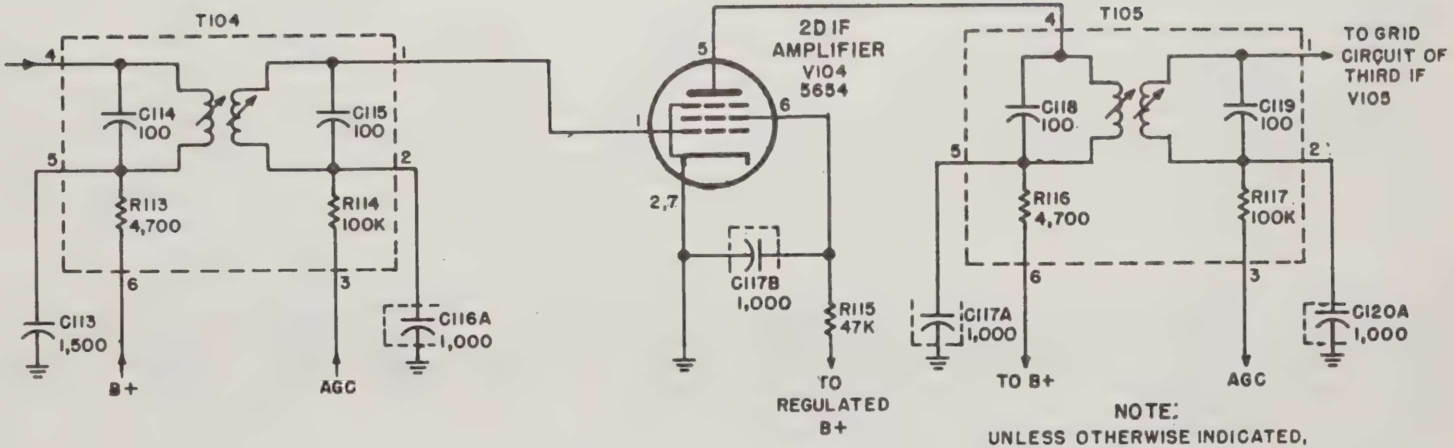


Figure 12. First IF amplifier V103, schematic diagram.



NOTE:
UNLESS OTHERWISE INDICATED,
RESISTANCES ARE IN OHMS,
CAPACITANCES ARE IN UUF.

TM5826-200-35-9

Figure 13. Second IF amplifier V104, schematic diagram.

b. Second IF Amplifier V104 (fig. 13). The second IF amplifier uses a miniature 5654 pentode as a voltage amplifier.

(1) Agc voltage from the agc circuit (par. 17) is applied to the grid (pin 1) through decoupling resistor R114 and the secondary winding of IF transformer T104. Resistor R114 and capacitor C116A form a grid decoupling network. The suppressor grid is at ground potential. B+ is applied to the screen grid (pin 6) through voltage dropping resistor R115. Capacitor C117B is the screen-grid bypass capacitor. The plate (pin 5) circuit is completed through the primary winding of IF transformer T105. Resistor R116 and capacitor C117A make up the plate decoupling network.

(2) The output of the first IF amplifier (V103) is applied through T104 to the control grid (pin 1) of the second IF amplifier (V104). The signal is amplified and applied to the third IF amplifier (V105) through IF transformer T105.

c. Third IF Amplifier V105 (fig. 14). The third IF amplifier stage uses a 5654 miniature pentode as a voltage amplifier.

(1) This stage is also controlled by agc. Since agc circuits present a common impedance to controlled stages, decoupling circuits are necessary to prevent undesirable coupling. Resistor R117 and capacitor C120 make up the grid decoupling network. The suppressor grid is at ground potential. B+ is applied to the plate (pin 5) through decoupling resistor R119 and the primary winding of T106. Capacitor C121A bypasses RF voltages to ground. Resistor R118 and capacitor C121B function as the screen-grid decoupling network. The capacitor across the primary of T106 and the capacitor in the secondary of T106 form part of the double-tuned plate (tank) circuit.

(2) The 18.9-mc signal is coupled to the control grid of V105 from previous IF amplifier V104 through IF transformer T105. The amplified signal at the plate of V105 is coupled to the grid of output IF amplifier V106.

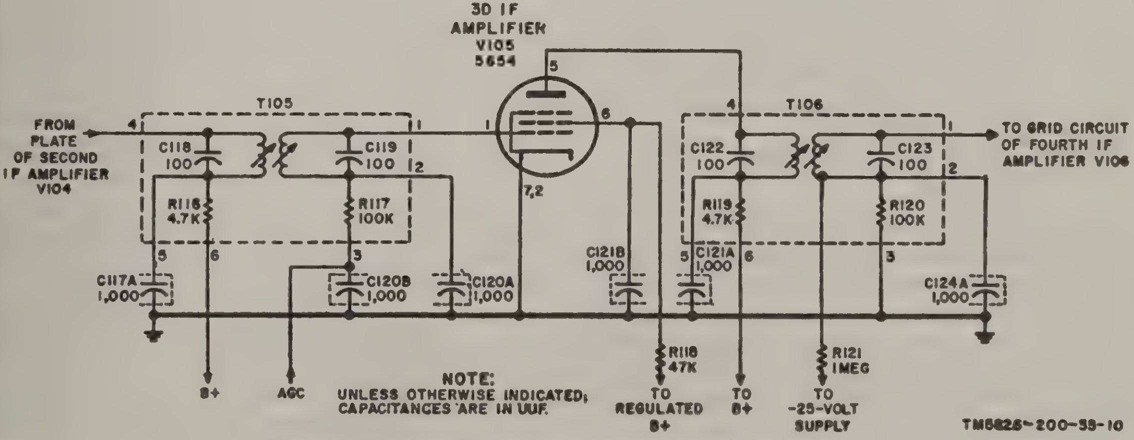


Figure 14. Third IF amplifier V105, schematic diagram.

d. Fourth IF Amplifier V106 (fig. 15). The fourth IF amplifier stage is a miniature 5654 pentode, which amplifies the signal voltage from the preceding IF stages.

(1) This stage is not agc controlled. However, a fixed negative bias is used in the grid circuit to prevent modulation distortion or possible clipping action. Approximately —2 volts bias (developed across resistors R168 and R169) is applied to the control grid (pin 1) through isolation resistor R121 and the secondary winding of T106. Resistor R120 is used to prevent shorting the fixed bias potential to ground. Capacitor C124A places the bottom of transformer T106 secondary tuned circuit at RF ground. B+ is applied to the screen grid (pin 6) through voltage dropping resistor R122. Capacitor C125C is the screen-grid bypass capacitor. The plate (pin 5) circuit is completed to B+ through the primary of transformer T107, decoupling resistor R123, and trap Z109. Capacitors C125A and C125B bypass RF voltages to ground. Transformer T107 differs from the other IF transformers in this receiver because it includes a small amount of capacity coupling, C130, to improve the low frequency response.

(2) The 18.9-mc signal is coupled to the control grid of V106 from previous IF amplifier V104 by transformer T106. The double-tuned (tank) circuits, located in T107, permit the proper degree of bandwidth to be coupled to the plate circuit of detector stage V107A through coupling capacitor C128 and isolation resistor R124.

17. Detector and Agc Amplifier, V107A and V108A

Detector stage V107A uses one half of a type 5726 double-diode tube connected as a shunt detector circuit to demodulate the 18.9-mc signal voltage. The dc output of the detector is applied between grid and cathode of agc amplifier V108A (one half of 5751) with the polarity being grid-negative. The audio output of the detector is coupled through a low-pass (noise) filter to audio amplifier V112A. Agc amplifier V108A keeps the rectified IF voltage at the detector constant.

a. Detector V107A. The detector (fig. 16) supplies a dc voltage to the agc amplifier and an audio signal for application to the audio amplifier.

(1) Current from the center tap (B—) of power transformer T108 flows through different parallel paths to ground. One path is through resistors R168 and R169 (point C to point D). Another path is through resistors R130 and R132 (point E to point J). Also through resistors R130, R131, R133, and R134 (point E to point F, to point G, to point H). Still another path is through the parallel circuit made up of resistor R175 and vacuum-tube V108B, resistors R129 and R128, vacuum-tube V107B when it is conducting, and resistors R133 and R134 (point B to point A, to point F, to point H). Current from the B— point on power transformer T108 also flows through the parallel circuit made up of resistors R175 and vacuum-tube V108B, resistors R129 and R128, and vacuum-tube V108A to B+.

(2) With no incoming signal, the voltage developed across points C and D is equal to the voltage developed across points A and B. However, the voltages are in series and oppose each other. Therefore the voltage across points A and D is zero and no bias is applied to the second detector (V107A). The agc delay tube (V107B) cannot conduct at this time because its plate is negative with respect to its cathode. The cathode of V107B is near zero potential with respect to ground while the plate is —2 volts with respect to ground.

(3) The positive alternation of an incoming signal will cause V107A to conduct and charge capacitor C128. During the next (negative) alternation, capacitor C128 will discharge through resistors R126, R128 and vacuum-tube V108A. Voltage variations across detector load resistor R126 are coupled to the first audio amplifier V112A.

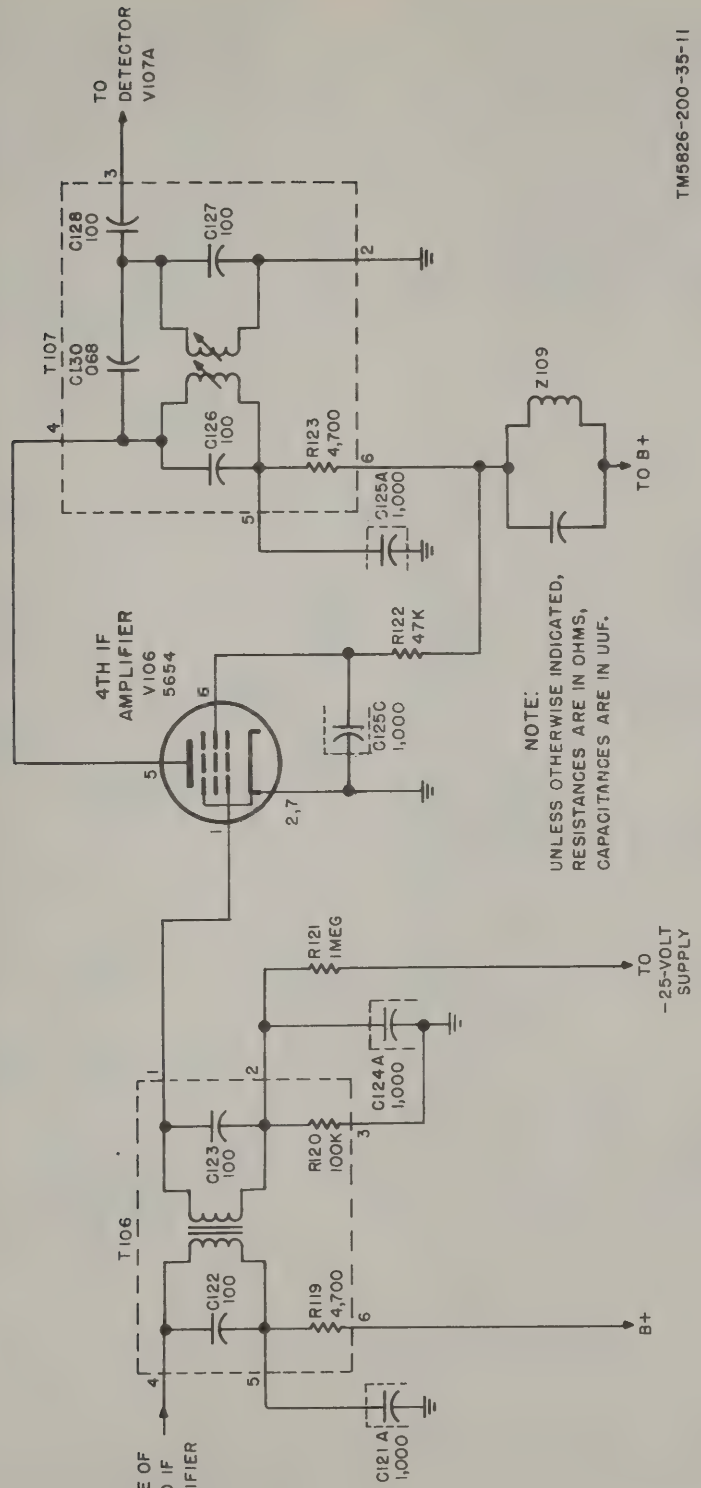


Figure 15. Fourth IF amplifier V106, schematic diagram.

(4) A diode test point is provided at the junction of filter components R157 and C131C. This test point is intended primarily to facilitate alinement, but also offers the repairman a convenient point of measurement.

b. Agc Circuit. The agc circuit (fig. 16) compensates for variations in signal amplitude at the receiver input. To provide maximum sensitivity during reception of weak signals, the agc action is delayed until a minimum critical RF signal level is reached.

(1) The dc output of the detector is applied between grid and cathode of agc amplifier V108A, with the polarity being grid-negative. Agc amplifier V108A is a dc amplifier with the output load resistance network connected between cathode (pin 3) and the —25-volt source; it is not a cathode follower, since the input voltage is applied between grid and cathode. The circuit, therefore, has a gain greater than unity and helps maintain a flat

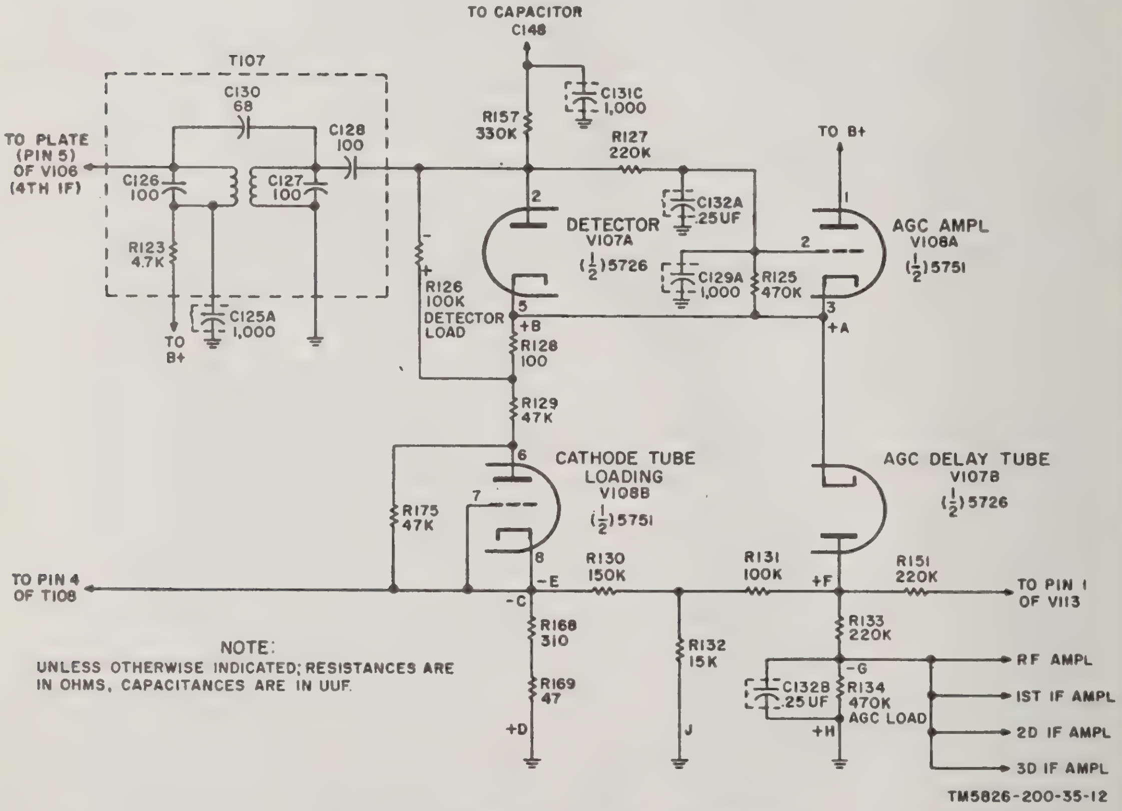


Figure 16. Detector and agc circuits, simplified diagram.

input-output (agc) characteristic. The cathode load resistance network compensates the agc and detector circuits for the change in dc output that would normally result from a change in battery voltage.

(2) Agc voltage is developed when the plate of V107B (fig. 16) is positive with respect to cathode. For a weak input signal, the cathode tube loading (V108B) functions as a comparatively high resistance. In the absence of an input signal, the voltage across the cathode load resistance network is sufficiently positive to overcome the negative 25-volt bias and a net positive voltage is applied to the cathode (pin 1) of agc delay tube V107B. This diode will not conduct until the voltage from the cathode to ground becomes more negative than the bias voltage (approximately —1.5-volts) present at the plate (pin 7) of V107B. When a signal is present and the detector is conducting, the dc voltage at pin 2 of V108A reduces the tube plate current and changes the net voltage on the cathode of V107B from positive through zero to increasing negative. When the critical negative voltage is reached, V107B starts to conduct, and the voltage at the plate continues to increase in the negative direction.

(3) As the signal input increases in amplitude, V108B conducts more and the internal resistance of the tube decreases. The reduced tube resistance decreases the total resistance between points A and B resulting in lower voltage between these points. Since the voltage across points A and B is in series opposition to the voltage across points E and F, a reduction in voltage across points A and B will make the cathode of the agc delay tube (V107B) negative with respect to its plate. The tube will then conduct and an increased current will flow through agc load resistor R134. Thus, the agc action is delayed until a minimum critical RF signal is reached, but operates with full amplification above that value. The agc voltage developed is applied to RF amplifier V101, and the first three IF amplifiers (V103, V104, and V105). The overall control gain is sufficient to reduce the output rise at the detector to less than 2 decibels (db) over the range from 30 to 100,000 microvolts of RF input.

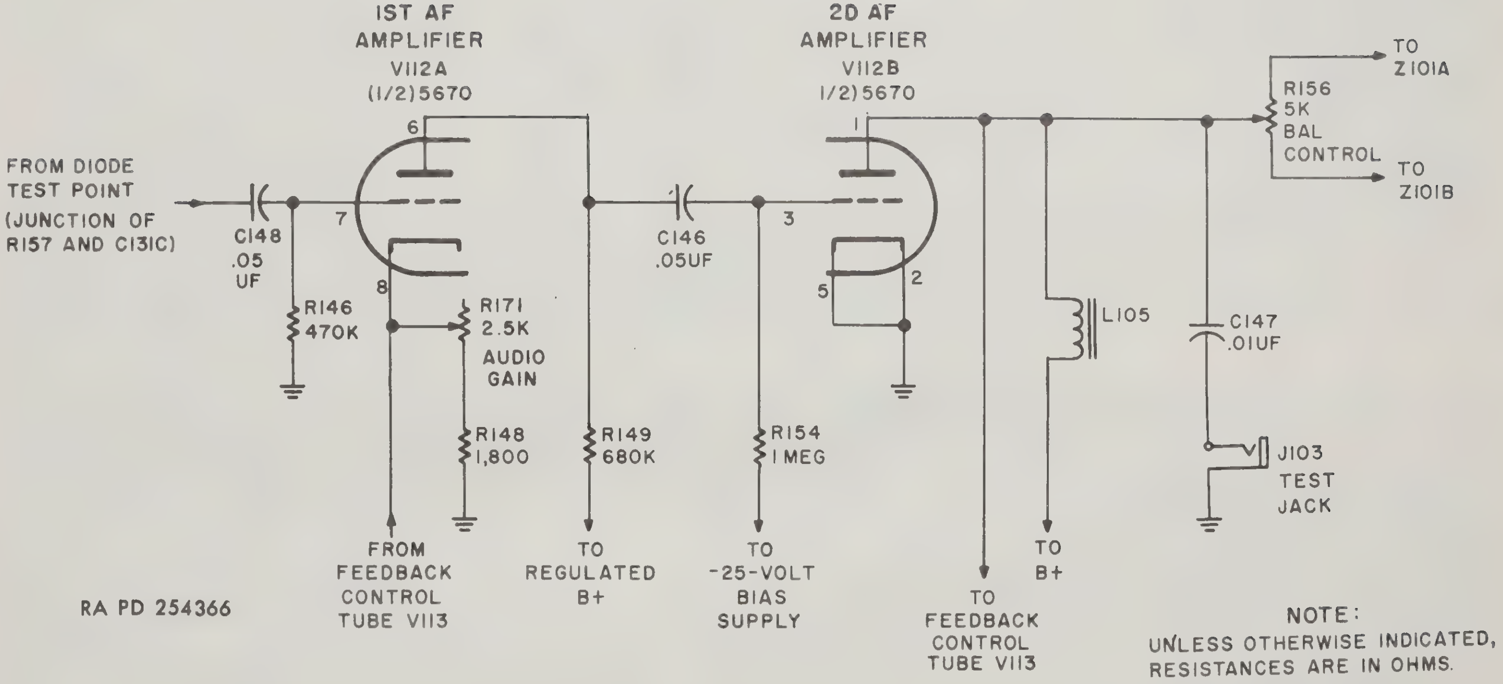
18. Audio Frequency Amplifier V112
(fig. 17)

The first AF amplifier is a resistance-coupled stage that uses one half of a 5670 miniature dual triode tube. The second half of V112 serves as the output audio-amplifier.

a. Self-bias for V112A is developed across cathode resistor R148 and audio gain control potentiometer R171 in series. Degeneration is introduced by the omission of a cathode bypass capacitor. Grid resistor R146 provides the necessary dc path between the control grid (pin 7) and cathode (pin 8) of V112A. The cathode serves as the injection point for negative feedback voltage.

b. The second half of V112 serves as the audio output amplifier. Approximately —4.5 volts fixed bias is applied to the control grid (pin 3) of V112B through grid resistor R154. The cathode (pin 2) is at ground potential. The plate (pin 4) of V112B is shunt-fed through choke coil L105. The 90- and 150-cps filters comprise the plate load for V112B.

c. Demodulated voltage from the detector (V107A) is coupled to the control grid (pin 7) of V112A through a low-pass filter (R157 and C131C) and coupling capacitor C148. The low-pass filter attenuates frequencies above approximately 1,000 cps to improve the signal-to-noise ratio of the receiver. The AF voltage developed across grid resistor R146 is amplified by V112A and coupled through capacitor C146 to the control grid of V112B. The output of V112B is applied directly to the arm of balance control R156. No coupling capacitor is used at this point, because dc blocking is accomplished in the 90- and 150-cps band-pass filters. Test jack J103 connects to the plate of V112B through capacitor C147 to facilitate alinement and troubleshooting.



NOTE:
UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS.

TM5826-200-35-14

Figure 17. AF amplifier V112, schematic diagram.

19. Feedback Circuit
(fig. 18).

The feedback circuit reduces the gain of the AF amplifiers (V112A and V112B) with increasing signal amplitude and flattens the agc characteristics. Negative feedback voltage from the plate of tube V112B is coupled through resistors R153 and R150 in series to the cathode of tube V112A. At the junction of R153 and R150, a shunt circuit to ground is established through the plate resistance of V113 (a 5654 tube connected as a triode). These three resistive elements form a T-network attenuator between the output and the input of the audio amplifiers. A negative potential from the agc circuit is applied to the grid of V113 and, in combination with a positive potential applied through resistors R165 and R174, modifies the effective plate resistance of the tube. Under conditions of weak signal input resulting in low agc voltage and therefore low bias applied to the grid of V113, the plate resistance is relatively low so that the network tends to reduce the negative feedback voltage, thus increasing the gain of the audio amplifier. When a stronger signal is applied to the input of the receiver, the agc voltage increases, thereby increasing the plate resistance of V113 and applying increased negative feedback voltage to the cathode of V112A. This reduces the gain of the audio amplifier. The overall effect is to compensate for the slight rise of output of the demodulated IF voltage applied to the audio amplifiers. This circuit also controls the amount of course softening (agc characteristics) obtained. The gain of the audio amplifiers, due to the applied feedback, is substantially independent of variations in voltage, tubes, and temperature; however, the absolute gain may be set to the desired value by adjusting R171.

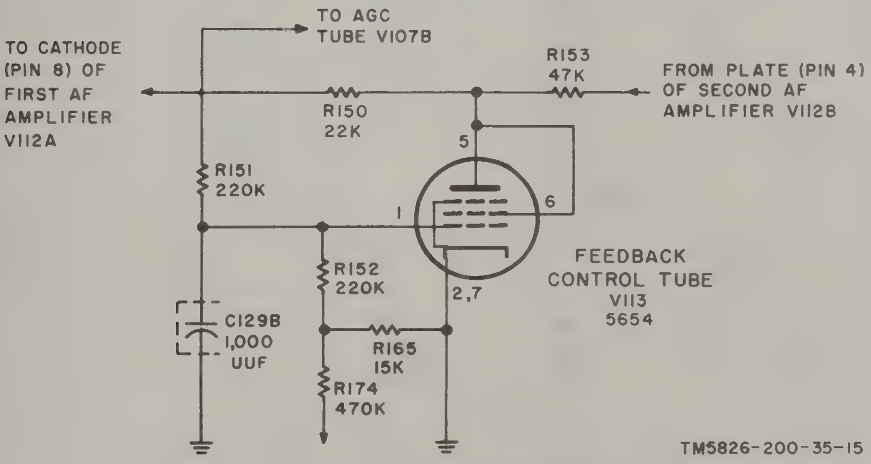


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Figure 18. Feedback circuit, simplified schematic diagram.

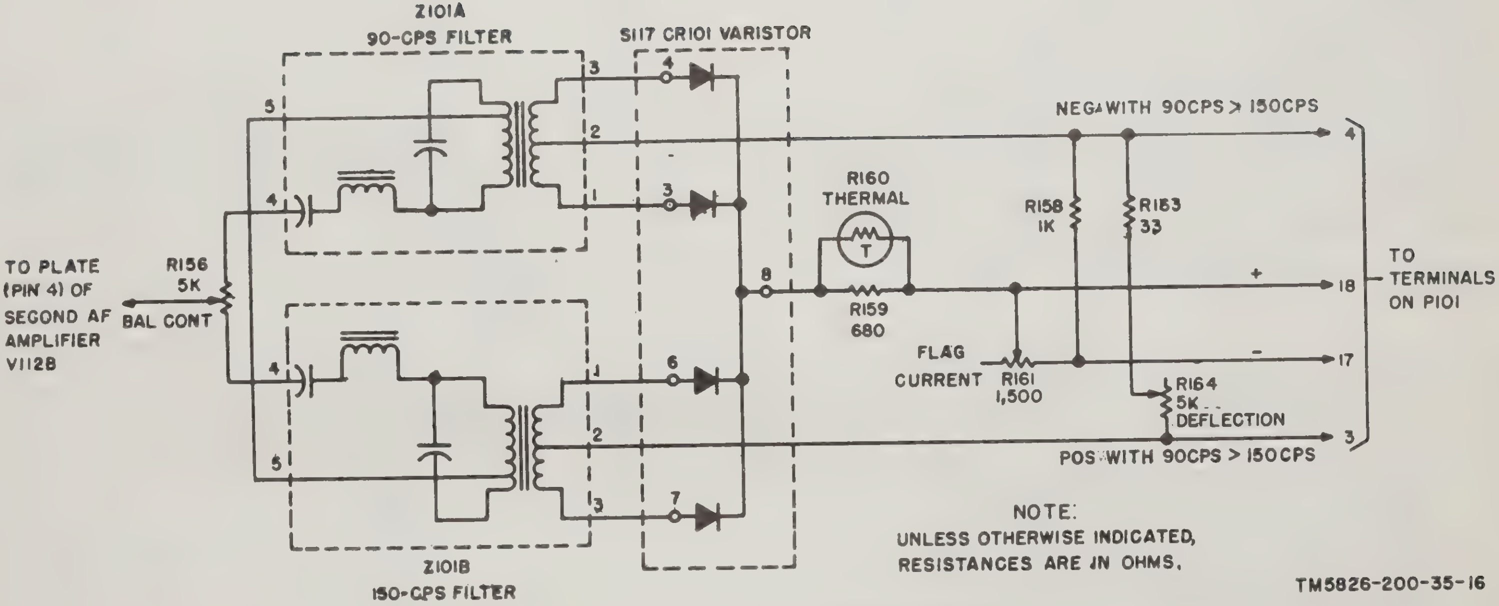
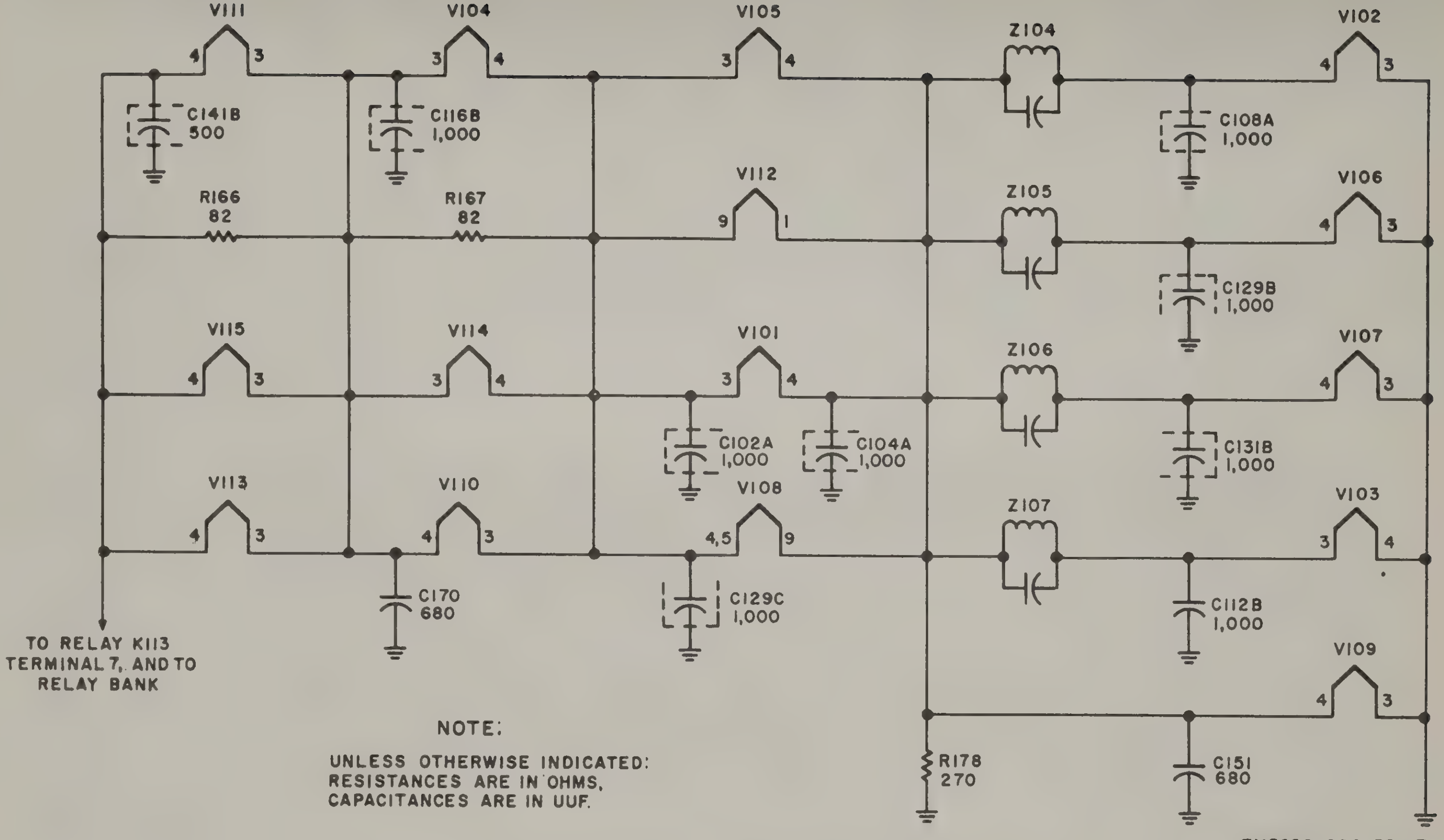


Figure 19. Indicator circuits, simplified schematic diagram.



NOTE:

UNLESS OTHERWISE INDICATED:
RESISTANCES ARE IN OHMS,
CAPACITANCES ARE IN UUF.

TM5826-200-35-17

Figure 20. Filament circuits, schematic diagram.

20. Indicator Circuits
(fig. 19)

The output of one side of balance control R156 is applied to the 9-cps filter and the output of the other side of R156 is applied to the 150-cps filter. The army of the balance control is connected to the plate of final audio amplifier V112B. Rotation of this control adjusts the indicated course center. The control is provided to compensate for relative differences of gain of the band-pass filters and the output rectifiers. The output winding of each filter is center-tapped. The outer ends of the windings are connected to four germanium diode rectifiers. Resistors R158, R159, R160, R161, R163, and R164 form the internal receiver load for the rectifiers. The *course* information for the external meters is taken across resistors R158 and R162. Deflection sensitivity adjustment is made by setting control R164 to the proper position. Voltage to operate the flag alarm movements is taken across resistor R161. Resistors R159 and R160 form a network to reduce any change in deflection and flag alarm sensitivity with variations in ambient temperatures. Resistor R160 has a high negative temperature coefficient so that as the temperature rises, a decrease in circuit loss through R160 compensates for an increase in the copper loss in the filters. Resistor R159 limits the effect of R160 when the temperature decreases. The receiver is designed to operate a maximum of three horizontal meter movements and two flag alarm movements of Indicator ID–48/ARN and Course Indicator ID–249A/ARN. The resistance of each horizontal meter movement is rated at 1,000 ohms and the full-scale current for each movement is 150 microamperes. The resistance of each flag alarm meter movement is rated at 1,000 ohms. Filters Z101A and Z101B separate the modulation into the 90- and 150-cps components. These two tones are separately rectified by CR101 and then applied to two separate meter movements for *course* and *on-off* indications.

21. Filament Circuits
(fig. 20).

A potential of 27.5 volts dc, from an external power (aircraft electrical system) source is applied to terminal 7 of relay K113. The filaments of the 15 tubes used in the receiver are connected in a series-parallel arrangement. To balance the filament current, two ballast resistors (R166 and R167) are placed in two of the parallel circuits. Equal potential points of the series strings are connected at four points on each string. This arrangement aids in averaging the voltage across the filaments and lengthens life expectancy of the tubes. To minimize feedback, chokes Z104, Z105, Z106, and Z107 are inserted in series with a number of the tube filaments. These tuned chokes are parallel-resonant at approximately 18.9 mc. Bypass capacitors are also used in the filament network where required.

22. Power Supply Circuits
(fig. 21)

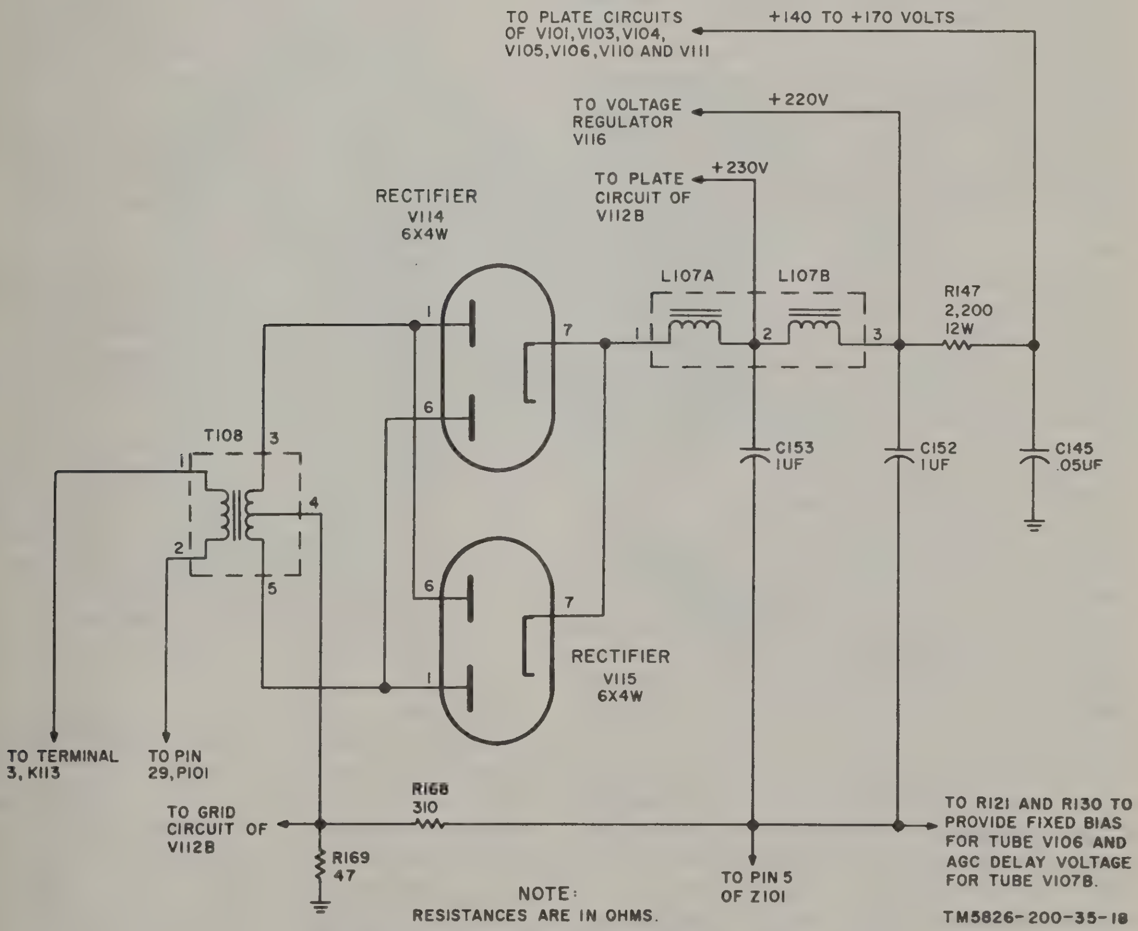
The power supply circuits in Radio Receiver R–746/AR consist of the plate supply circuit, dc voltage supply circuits, high voltage filter circuit, and the bias supply.

a. Primary Power Supply. The plate supply circuits of the receiver are operated from the 115-volt, 400-cycle generator in the aircraft. This voltage may vary from 100 to 120 volts and still provide satisfactory operation. The 115 volts ac is applied through one pair of contacts of the on-off relay (K113). This relay is a hermetically sealed unit that contains two pairs of normally open contacts. The relay is energized by the +26.5-volt dc circuit by means of a separate lead on the control panel. The receiver plate supply consists of power transformer T108, rectifier tubes V114 and V115, filter chokes L107A and L107B, bias resistor R147, and filter capacitors C145, C152, and C153. The filter network has a high attenuation in the frequency range of 320 to 1,700 cps. Approximately 40 watts is required to operate the plate supply effectively.

b. Dc Voltage Supply. The negative side of the 26.5-volt dc supply is grounded. The receiver is designed so that it is not critical with respect to input voltage changes within the limits specified. Any dc voltage from 24 to 29 volts will provide satisfactory operation.

c. High Voltage Filter Circuit. The high voltage from transformer T108 and rectifiers V114 and V115 is applied to the high voltage filter. Inductors L107A and L107B, with filter capacitors C152 and C153, functions as a pi-section filter. Two circuits are connected at the output of the filter. One of the circuits consists of resistor R155 and tube V116. This circuit provides a regulated 150-volt supply for operation of the mixer and the oscillator plate and screen grids, the oscillator tripler screen grids, the first, second, and third IF amplifier screen grids, the dc amplifier tube, and fixed bias for the control grid of the feedback control tube. Voltage regulator tube V116 maintains the gain of the receiver at a constant level regardless of changes in input voltage by holding these voltages which are critical. The other circuit, connected at the output of the filter, provides approximately 160 volts dc for the plates of the RF, and oscillator tripler tubes.

d. Bias Supply. A fixed dc bias is required in the agc amplifier circuit, final audio amplifier V112B, and final IF amplifier V106. This bias voltage is developed across resistors R168 and R169 in the B— to ground line. A total of approximately —25 volts is available. Positive bias voltage is also obtained from the high voltage filter supply for the audio amplifier and feedback circuit tubes V112A and V113.



NOTE:
RESISTANCES ARE IN OHMS.

Figure 21. Power supply circuits, schematic diagram.

CHAPTER 3

TROUBLESHOOTING

Section I. GENERAL TROUBLESHOOTING TECHNIQUES

23. General Instructions

Troubleshooting at field and depot maintenance level includes all the techniques required to isolate a defective part. The systematic troubleshooting procedure begins with the operational and sectionalization checks, and is continued on to include the localizing, and isolating techniques. To determine which component of the radio set is at fault, system troubleshooting is most efficiently performed by using a substitution method; that is, the replacement of a suspected component by a component known to be good. This is the quickest and most practical method since each component depends upon one or more of the other components for proper functioning. Having determined which component is defective, refer to the troubleshooting chart (par. 30*d*) for aid in isolating the trouble. The glide slope portion of Radio Receiving Set AN/ARN–30 consists of four major, removable components; Mounting MT–791/U, Radio Receiver R–746/AR, crystal relay subchassis (fig. 22), and associated indicators. Any of the four major components may be replaced by a component known to be operating properly.

24. Troubleshooting Procedures

a. General. The first step in servicing a defective radio set is to sectionalize the fault. Sectionalization means tracing the fault to a major component or circuit responsible for abnormal operation. The second step is to localize the fault. Before making any extensive tests to isolate the circuit of a component causing trouble, make the following checks:

(1) Check all tubes (par. 25) by replacing each individually with a tube known to be good. If the trouble is not corrected through such replacement, always replace the original tube.

(2) Make a careful visual inspection for obvious mechanical or electrical defects, such as broken or faulty terminal connections, stripped wire insulation, broken wiring connections, and blistered or charred resistors or other sign of overload.

(3) If no obvious signs of trouble are indicated, check equipment performance. Compare the indications observed with the normal indications on the equipment performance checklist (par. 26*c*). Follow the corrective measures for any indications that are abnormal.

b. Sectionalization. Listed below is a group of tests arranged to reduce unnecessary work; and to aid in tracing trouble in a defective receiver. The first step is to locate the section or sections at fault by the following methods:

(1) *Visual inspection.* Visual inspection will help to locate the faults without testing or measuring circuits. All visual signs should be observed and an attempt made to sectionalize the fault to a particular section.

(2) *Operational tests.* Operational tests frequently indicate the general location of trouble. In many instances, the test will help to determine the exact nature of the fault. The equipment performance check list (par. 26) is a good operational test. Additional operational tests are given in paragraph 30.

c. Localization. The tests listed below will aid in isolating the trouble. First, localize the trouble to a single stage or circuit, and then isolate the trouble within that circuit by voltage, resistance, and continuity measurements. Use the following methods of trouble localization:

(1) *Signal tracing.* Signal tracing will help in isolating a trouble to a specific circuit at fault.

(2) *Voltage and resistance measurements.* These measurements will help locate the individual component parts at fault. Use capacitor and resistor color codes (figs. 23 and 24) to find the value of the components. Use voltage and resistance diagrams (fig. 25) to find normal readings, and compare them with readings taken.

(3) *Troubleshooting chart.* The trouble symptoms listed in the chart (par. 30) will aid in localizing trouble to a component part.

(4) *Intermittent troubles.* In all these tests, the possibility of intermittent troubles should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the equipment. Check the wiring and all connectors.

(5) *Signal substitution.* Signal substitution (par. 31) procedures enable the repairman to localize a trouble quickly to a stage. A signal generator may be used in signal substitution procedures.

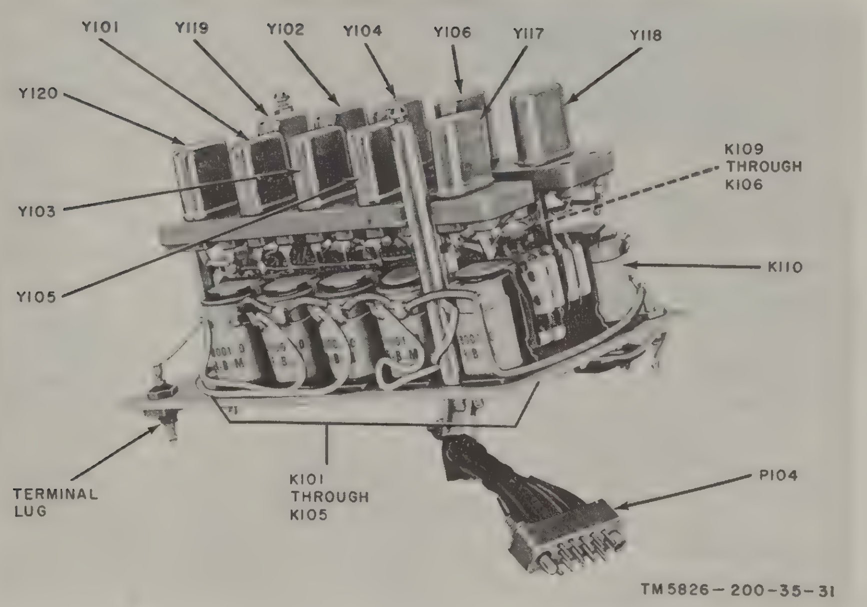
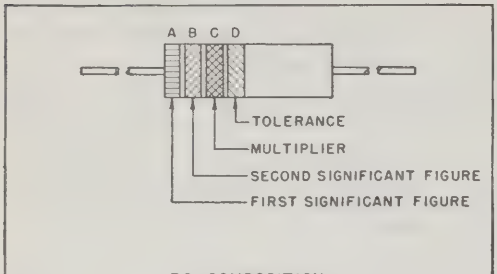


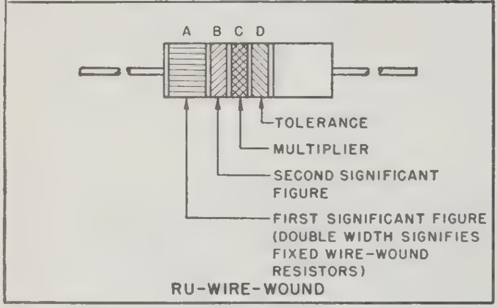
Figure 22. Crystal relay subchassis, front oblique view.

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)

AXIAL-LEAD RESISTORS
(INSULATED)

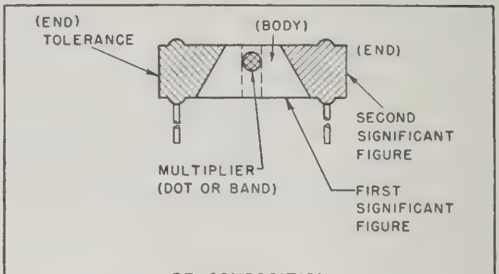


RC-COMPOSITION

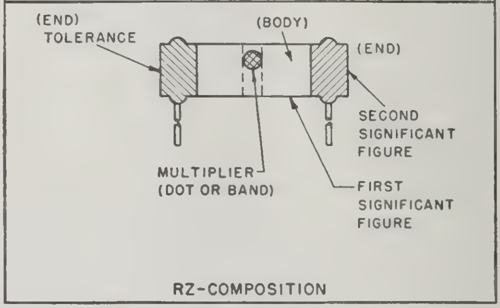

A B C D
TOLERANCE
MULTIPLIER
SECOND SIGNIFICANT FIGURE
FIRST SIGNIFICANT FIGURE (DOUBLE WIDTH SIGNIFIES FIXED WIRE-WOUND RESISTORS)

RU-WIRE-WOUND

RADIAL-LEAD RESISTORS
(UNINSULATED)



RZ-COMPOSITION



RZ-COMPOSITION

RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	± 20
BROWN	1	BROWN	1	BROWN	10	SILVER	± 10
RED	2	RED	2	RED	100	GOLD	± 5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

*FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH. WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

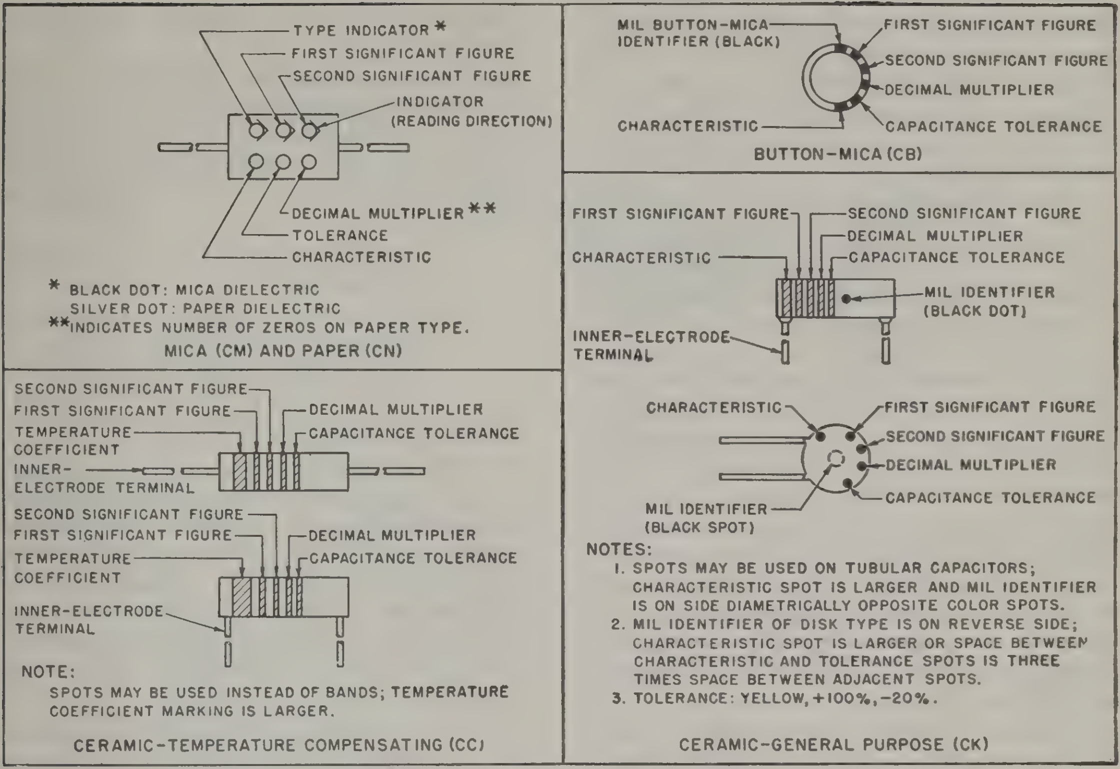
EXAMPLES (BAND MARKING):
10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

EXAMPLES (BODY MARKING):
10 OHMS ±20 PERCENT: BROWN BODY; BLACK END; BLACK DOT OR BAND; BODY COLOR ON TOLERANCE END.
3,000 OHMS ±10 PERCENT: ORANGE BODY; BLACK END; RED DOT OR BAND; SILVER END.

STD-R1

Figure 23. MIL–STD resistor color code marking.

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)



* BLACK DOT: MICA DIELECTRIC
SILVER DOT: PAPER DIELECTRIC
**INDICATES NUMBER OF ZEROS ON PAPER TYPE.

MICA (CM) AND PAPER (CN)

BUTTON-MICA (CB)

NOTE:
SPOTS MAY BE USED INSTEAD OF BANDS; TEMPERATURE COEFFICIENT MARKING IS LARGER.

CERAMIC-TEMPERATURE COMPENSATING (CC)

NOTES:
1. SPOTS MAY BE USED ON TUBULAR CAPACITORS; CHARACTERISTIC SPOT IS LARGER AND MIL IDENTIFIER IS ON SIDE DIAMETRICALLY OPPOSITE COLOR SPOTS.
2. MIL IDENTIFIER OF DISK TYPE IS ON REVERSE SIDE; CHARACTERISTIC SPOT IS LARGER OR SPACE BETWEEN CHARACTERISTIC AND TOLERANCE SPOTS IS THREE TIMES SPACE BETWEEN ADJACENT SPOTS.
3. TOLERANCE: YELLOW, +100%, −20%.

CERAMIC-GENERAL PURPOSE (CK)

CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC[1]				TOLERANCE[2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC		CC
											OVER 10UUF	10UUF OR LESS	
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		−30
RED	2	100	2	C	H		X	2		2	2		−80
ORANGE	3	1,000	3	D	J	D			30				−150
YELLOW	4	10,000	4	E	P								−220
GREEN	5		5	F	R						5	0.5	−330
BLUE	6		6		S								−470
PURPLE (VIOLET)	7		7		T	W							−750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	−330(±500)[3]
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-C1

Figure 24. MIL–STD capacitor color code marking.

25. Tube Testing Techniques

When trouble occurs, check all cabling, connections, and batteries before removing any tubes. Try to isolate the trouble to a component or stage. If tube failure is suspected, use the applicable procedure below to check the tubes.

***Caution:* Do not rock or rotate a tube when removing it from a socket; pull it straight out with a tube puller.**

a. Use of Tube Tester. Remove and test one tube at a time. Discard a tube only if its defect is obvious or if the tube tester shows it to be defective. Do not discard a tube that tests at or near its minimum test limit on the tube tester. Put back the original tube, or insert a new one if required, before testing the next one. When a tube tester, such as Electron Tube Test Set TV–7/U, or equal, is available, test the tubes (according to the instructions supplied with the tube tester) for shorts, leakage, and either emission or mutual conductance. If a tube tester is not available, a similar receiver in good operating condition can be used to test the tubes by the substitution method described below. If neither a tube tester nor another receiver is available, the tubes can be checked by substituting spares as described in *c* below.

b. Checking Tubes by Substitution in a Similar Receiver. Tune a similar receiver which is in good operating condition to a signal that is not subject to fading (moderate strength). Make the substitutions from the faulty receiver to a corresponding position in the good receiver, one at a time. Tap each tube under test; if noise or abnormal change in output is observed, replace the tube.

c. Checking Tubes by Substituting Spares. Replace the tubes in the faulty receiver, one at a time, with the spare tubes. Follow the same general procedure outlined in *b* above. Check the tubes in Radio Receiver R–746/AR as follows:

(1) Remove the receiver from the mounting (par. 7).

(2) Remove the right-hand side cover (side panel) to gain access to the top of the receiver chassis (par. 42).

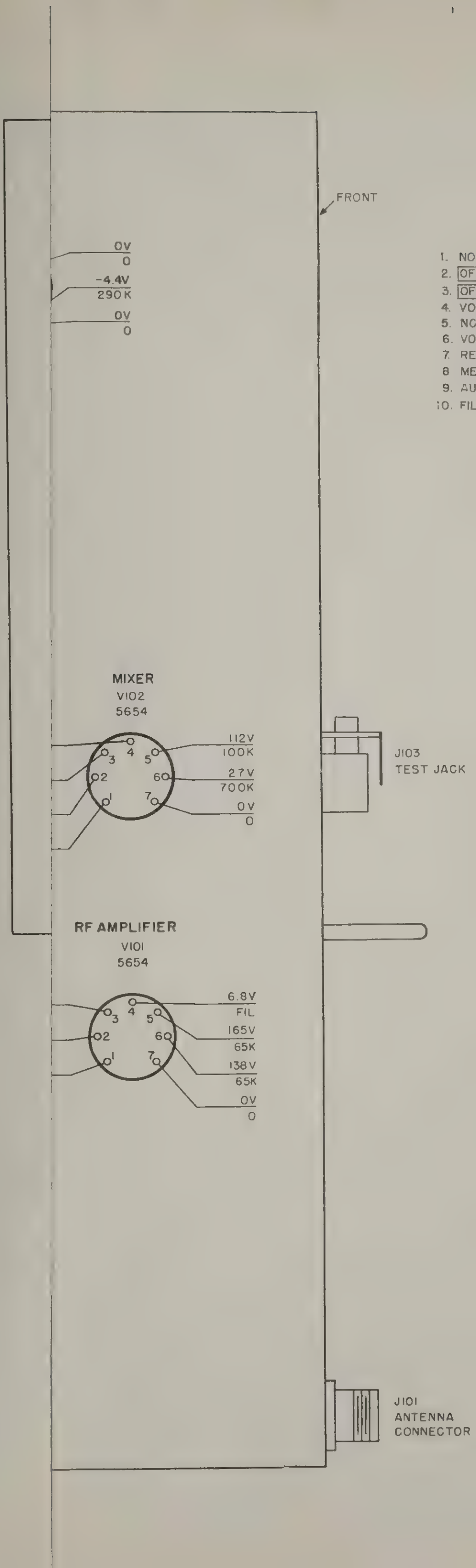
26. Equipment Performance Check List

a. General. The equipment performance check list is a procedure to systematically check equipment performance. All corrective measures that do not require test equipment are given in the *corrective measures* column. When using this check list, start at the beginning and follow each step in order. If the corrective measures indicated do not correct the receiver, further trouble shooting is required.

b. Procedure. Place the receiver in operation. Allow the equipment to warm up for 5 minutes. Operate the receiver as shown in the check list below:

c. Equipment Performance Check List.

	Step	Unit	Action	Normal indication	Corrective measures
PREPARATORY	1	Antenna	Connect aircraft glide slope antenna cable on front of receiver (J101).		
	2	Control panel	Turn VOL knob to OFF		
	3	Control panel	Turn channel selector to desired channel.		
EQUIPMENT PERFORMANCE	4	Control panel	Turn VOL knob clockwise to ON.	Receiver tubes light. The horizontal needle on each indicator is actuated.	Check aircraft inverter. Check primary power (26.5 volts dc). Check connector (P101 and J201).
	5	Receiver	Plug headset into test jack J103.	Rushing noise (tube hiss)	Check V114, V115, and V112 by substitution.
	6	Receiver	Unplug V107*	Click heard in headset	Check V112.
	7	Receiver	Unplug V106	Click heard in headset	Check V107.



NOTES:

1. NORMAL INPUT VOLTAGES.
2. OFF-ON-VOL SWITCH IN ON POSITION FOR VOLTAGE MEASUREMENTS.
3. OFF-ON-VOL SWITCH IN OFF POSTION FOR RESISTANCE MEASUREMENTS.
4. VOLTAGES AND RESISTANCES MEASURED TO CHASSIS GROUND.
5. NC INDICATES NO CONNECTION.
6. VOLTAGE READINGS ABOVE LINE, RESISTANCE READINGS BELOW LINE.
7. RECEIVER SET TO STANDARD DEFLECTION, 700 UV RF INPUT LEVEL.
8 MEASUREMENTS ARE MADE WITH VTVM.
9. AUDIO GAIN CONTROL SET TO STANDARD TEST CONDITIONS.
10. FIL INDICATES FILAMENTS.

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25. Tube Testing Techniques

When trouble occurs, check all cabling, connections, and batteries before removing any tubes. Try to isolate the trouble to a component or stage. If tube failure is suspected, use the applicable procedure below to check the tubes.

***Caution:* Do not rock or rotate a tube when removing it from a socket; pull it straight out with a tube puller.**

a. Use of Tube Tester. Remove and test one tube at a time. Discard a tube only if its defect is obvious or if the tube tester shows it to be defective. Do not discard a tube that tests at or near its minimum test limit on the tube tester. Put back the original tube, or insert a new one if required, before testing the next one. When a tube tester, such as Electron Tube Test Set TV–7/U, or equal, is available, test the tubes (according to the instructions supplied with the tube tester) for shorts, leakage, and either emission or mutual conductance. If a tube tester is not available, a similar receiver in good operating condition can be used to test the tubes by the substitution method described below. If neither a tube tester nor another receiver is available, the tubes can be checked by substituting spares as described in *c* below.

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(1) Remove the receiver from the mounting (par. 7).

(2) Remove the right-hand side cover (side panel) to gain access to the top of the receiver chassis (par. 42).

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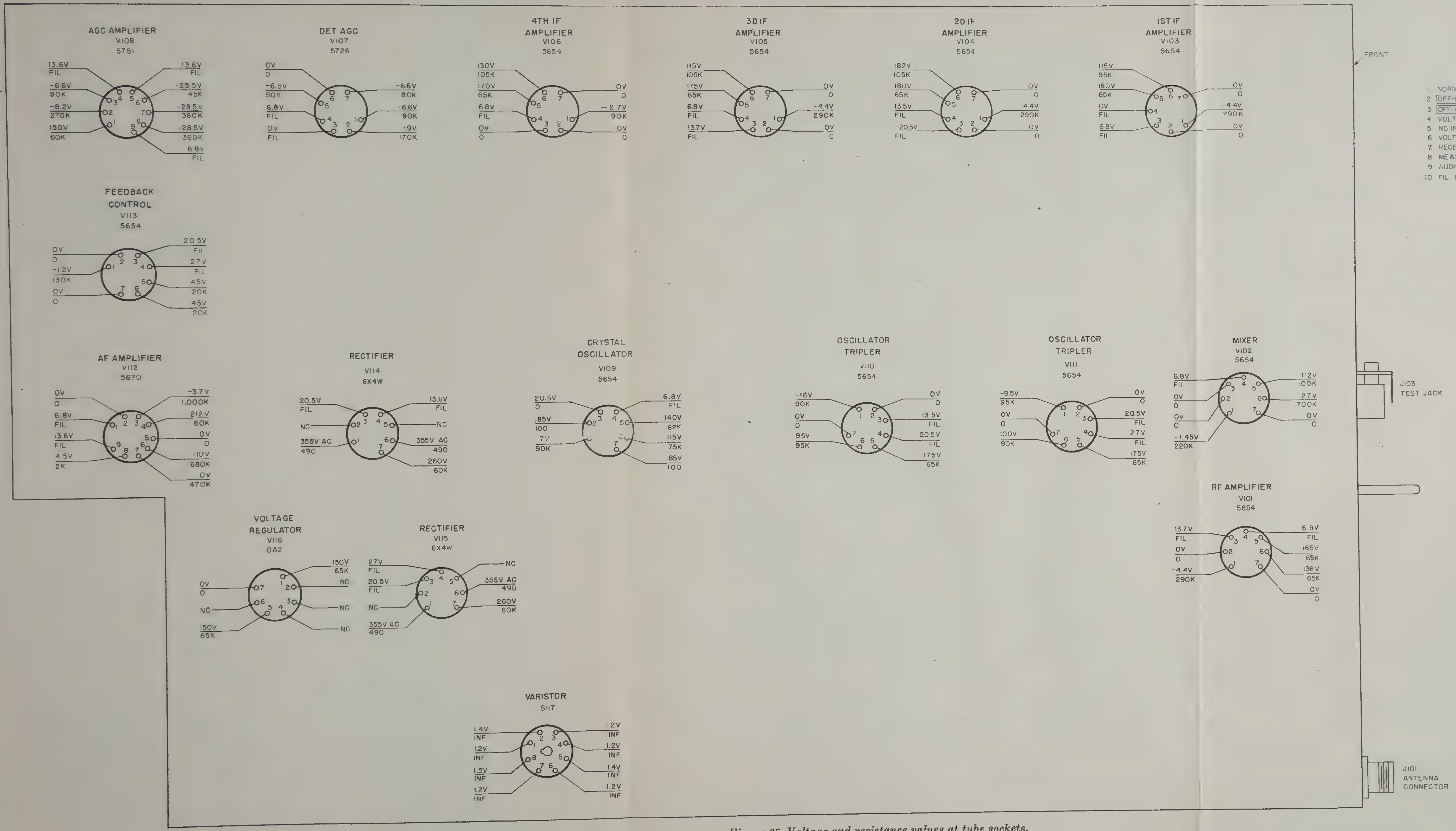
EQUIPMENT PERFORMANCE	4	Control panel	Turn VOL knob clockwise to ON.	Receiver tubes light. The horizontal needle on each indicator is actuated.	Check aircraft inverter. Check primary power (26.5 volts dc). Check connector (P101 and J201).
	5	Receiver	Plug headset into test jack J103.	Rushing noise (tube hiss)	Check V114, V115, and V112 by substitution.
	6	Receiver	Unplug V107*	Click heard in headset	Check V112.
	7	Receiver	Unplug V106	Click heard in headset	Check V107.



NOTES

1. NORMAL INPUT VOLTAGES
2 OFF-ON-VOL SWITCH IN ON POSITION FOR VOLTAGE MEASUREMENTS
3 OFF-ON-VOL SWITCH IN OFF POSTION FOR RESISTANCE MEASUREMENTS
4 VOLTAGES AND RESISTANCES MEASURED TO CHASSIS GROUND
5 NC INDICATES NO CONNECTION
6 VOLTAGE READINGS ABOVE LINE, RESISTANCE READINGS BELOW LINE
7. RECEIVER SET TO STANDARD DEFLECTION, 700 UV RF INPUT LEVEL
8 MEASUREMENTS ARE MADE WITH VTVM
9 AUDIO GAIN CONTROL SET TO STANDARD TEST CONDITIONS
10 FIL INDICATES FILAMENTS

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Figure 25. Voltage and resistance values at tube sockets.

c. Equipment Performance Check List—Continued

	Step	Unit	Action	Normal indication	Corrective measures
EQUIPMENT PERFORMANCE	8	Receiver	Unplug V105	Click heard in headset	Check V106.
	9	Receiver	Unplug V104	Click heard in headset	Check V105.
	10	Receiver	Unplug V103	Click heard in headset	Check V104.
	11	Receiver	Unplug V102	Click heard in headset	Check V103.
	12	Receiver	Unplug V101	Click heard in headset	Check V102.
	13	Receiver	Touch antenna with metal object.	Click heard in headset	Check V101, V109, V110, and V111.

* Remove tubes with one quick straight upward motion.

27. Test Equipment Required

The following chart lists the test equipment required for troubleshooting Radio Receiver R–746/AR, the associated technical manuals, and the assigned common names.

Test Equipment	Technical manual	Common name
Electronic Equipment Maintenance Kit MK–428/AR.	See note below	Test set
Signal Generator AN/GRM–4.	See note below	Signal generator
Multimeter TS–352/U.	TM 11–5527	Multimeter
Electron Tube Test Set TV–7/U.	TM 11–5083	Tube tester
Electron Tube Test Set TV–2/U.	TM 11–2661	Tube tester

Note. Refer to instruction book packed with the equipment.

Section II. TROUBLESHOOTING RADIO RECEIVER R–746/AR

Caution: **Do not attempt removal or replacement of parts before reading the instructions given in paragraph 42.**

28. Checking Filament and B+ Circuits for Shorts

The purpose of this test is to prevent further damage to the unit if a short circuit does exist.

a. When to Check. When any of the following conditions apply, check for short circuits and clear the trouble before applying power to the unit.

(1) When abnormal symptoms reported from operational tests indicate possible power supply troubles (steps 4 and 5, of the equipment performance check list (par. 26)).

(2) When the receiver is being serviced and the nature of the abnormal symptoms is not known.

b. Conditions for Tests. To prepare for the short circuit tests, perform the following steps:

(1) Remove the receiver from the mounting (par. 7).

(2) Disconnect all cable.

(3) Remove all tubes (to check the filament circuits).

c. Measurements. Make the resistance measurements indicated in the following chart. If abnormal results are obtained, make the additional isolating checks outlined. When the faulty part is found, repair the trouble before applying power to the receiver.

Short circuit tests		
Point of measurement	Normal indication	Isolating procedure
Between terminals 2 and 1 of plug P101 (fig. 34).	Infinite resistance	A finite resistance indicates a short circuit in the filament wiring. Check continuity of each wire (fig. 34) to locate the short.
From pin 7 of V114 and/or V115 (fig. 34) to ground.	Resistance reading of approximately 60,000 ohms. Ohmmeter pointer should indicate charging of filter capacitors.	If resistance is extremely low or zero, check for a shorted filter capacitor, C153 or C154, and for short-circuited high-voltage wiring. If resistance is appreciably lower, check for a shorted bypass capacitor in one of the plate or screen-grid circuits (fig. 34), or leakage in one of the filter capacitors C153, C154 or C145. If the resistance is appreciably higher than normal, check for an open filter component, L107A and L107B, or bias resistor R168 and R169.

29. Test Setup

(fig. 26).

Bench tests of the receiver require connection to a power source and to various test equipments. Remove the receiver from its mount (par. 7) and make the test setup outlined below.

a. Power-Supply Connections.

(1) The test set provides operating voltages for the receiver. Connect J1 of the test set to P101 of the receiver.

(2) Connect the test set primary power input clamps to a 24- to 30-volt dc source; do not exceed a 30-volt input.

b. Test Equipment. The test equipment shown in the test setup diagram (fig. 26) is listed in paragraph 27.

(1) Various functions in Radio Receiver R–746/AR can be checked with the test set. A jack, with a connecting switch, is provided on the test set to permit connecting an external cross-pointer indicator to give a visual indication of the receiver output similar to that seen by a pilot during normal use. For detailed information on the use of Maintenance Kit MK–428/AR, refer to the instruction book packed with the maintenance kit.

(2) Signal Generator AN/GRM–4 is designed for testing and alining glide slope receivers, such as Radio Receiver R–746/AR, and similar apparatus which operate within the frequency range of the generator. For detailed information on the use of the signal generator, refer to the instruction book packed with the generator.

(3) The 52-ohm, 6-db pad is a T-pad with 6-db attenuation when connected between the signal generator and the receiver which has an unbalanced 52-ohm input.

30. Localizing Trouble

a. General. Procedures for localizing troubles to the AF, IF, and RF sections of the receiver, and for localizing troubles to a stage within the various sections are given in the troubleshooting chart (*d* below). Parts location is indicated in figures 27 through 30. Depending on the nature of the operational symptoms, one or more of the localizing procedures will be necessary. When use of the procedures results in localization of the trouble to a particular stage, use the techniques outlined in paragraph 24 to isolate the trouble to a particular part.

b. Use of Chart. The troubleshooting chart supplements the operational checks detailed in the equipment performance check list (par. 26). If previous operational checks have resulted in reference to a particular item of this chart, go directly to the referenced item. If no operational symptoms are known, begin with item 1 of the

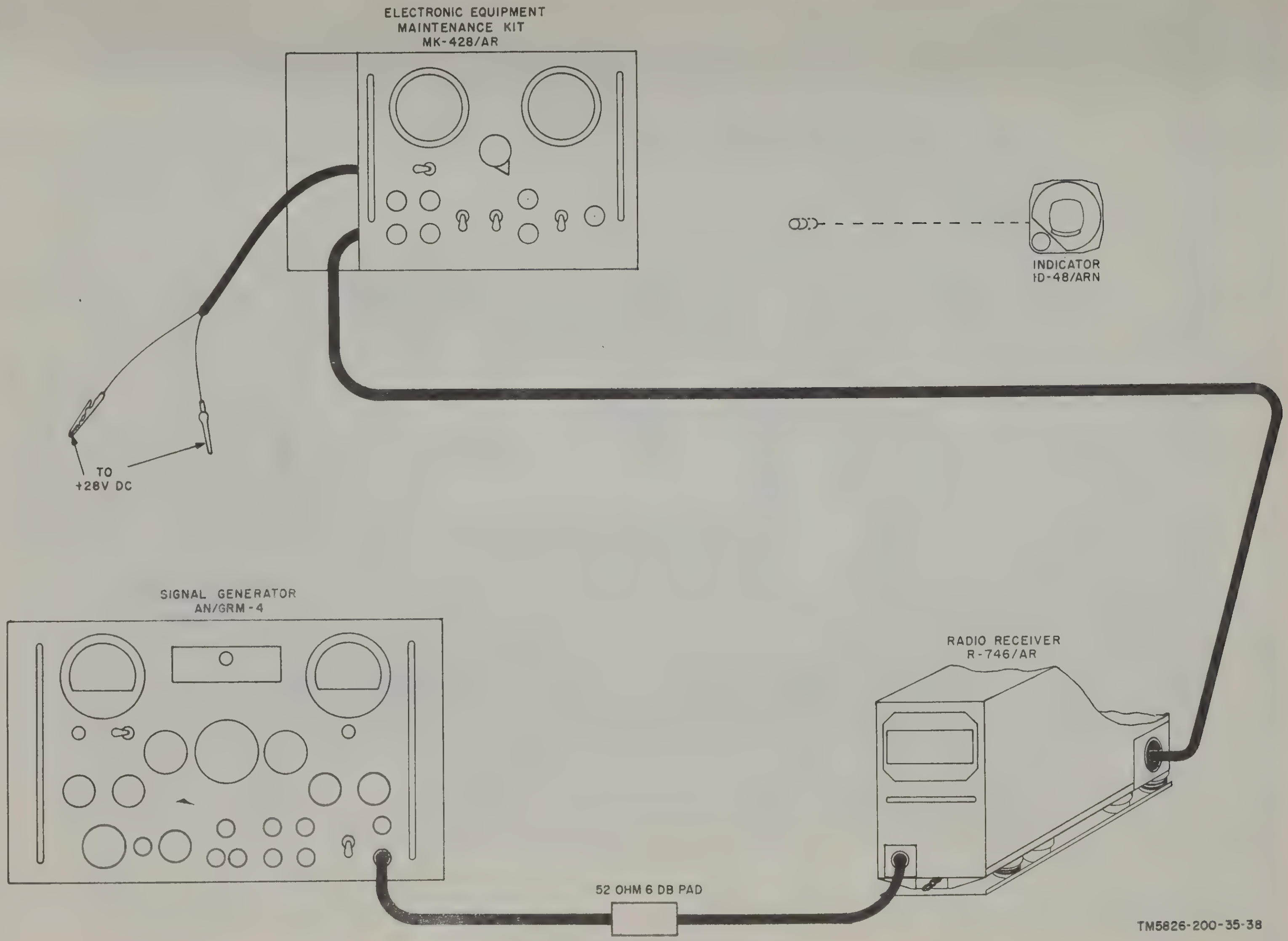


Figure 26. Test setup diagram.

equipment performance check list and proceed until the trouble is located.

Caution: **If operational symptoms are not known, or they indicate the possibility of short circuits within the receiver, make the short circuit checks (par. 28) before applying power to the unit.**

c. Conditions for Tests. Conduct all checks outlined in the chart with the receiver connected to a power source as described in paragraph 29*a*.

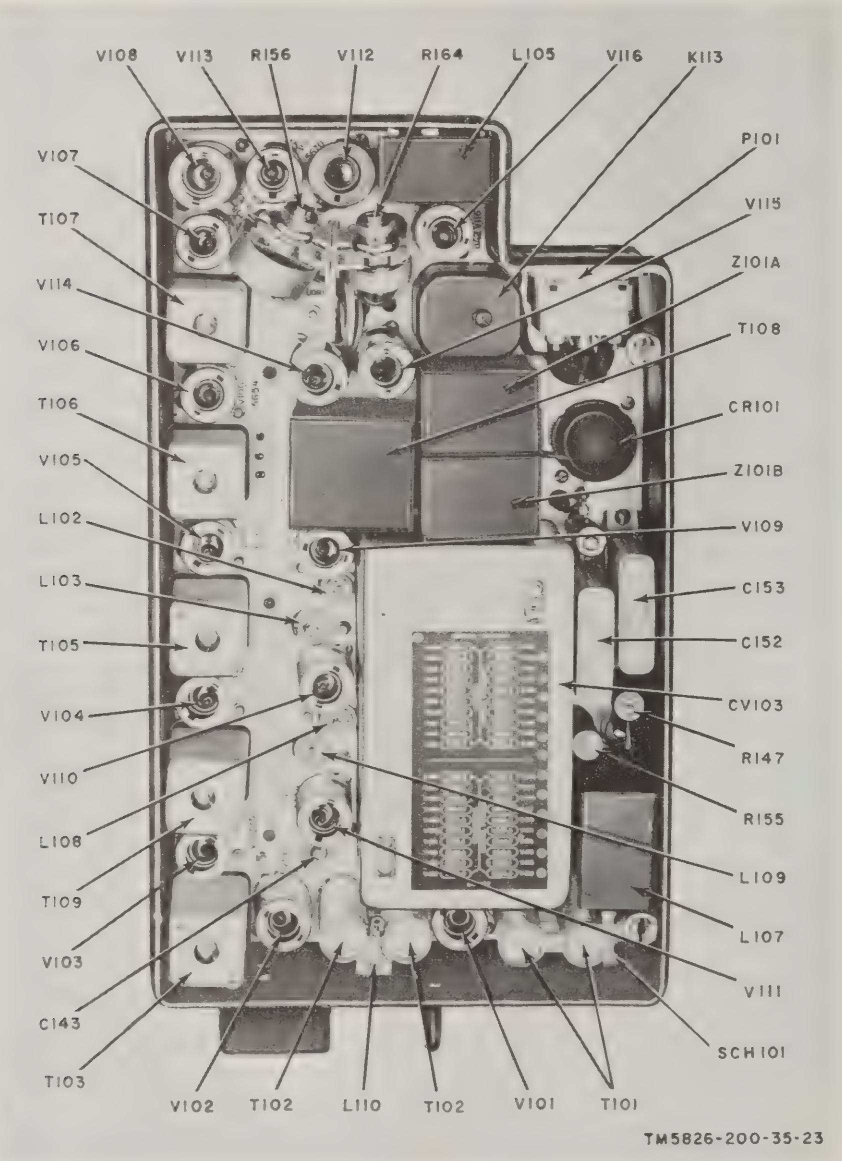


Figure 27. Radio Receiver R–746/AR, top view.

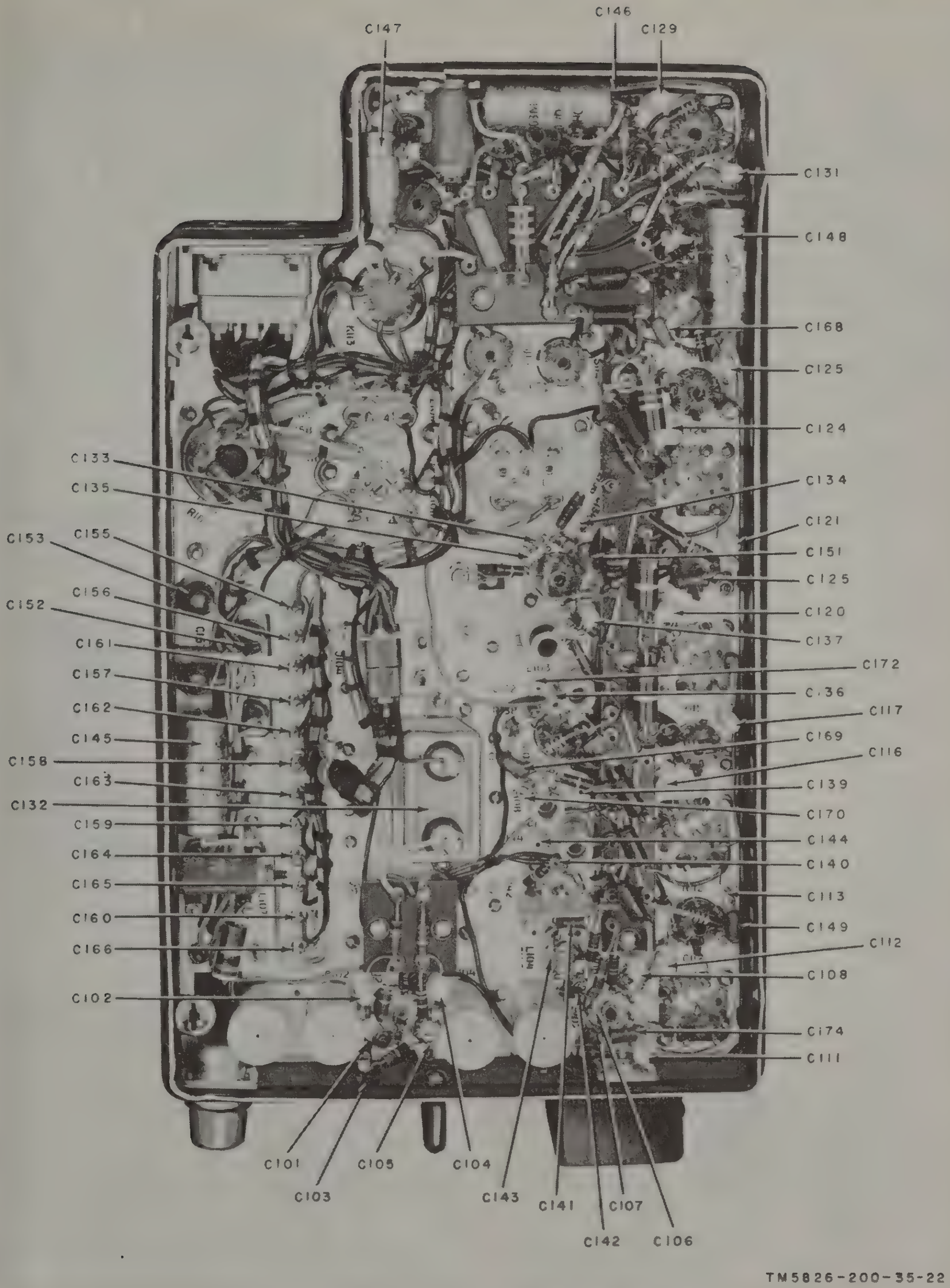


Figure 28. Radio Receiver R–746/AR, bottom view; capacitor location.

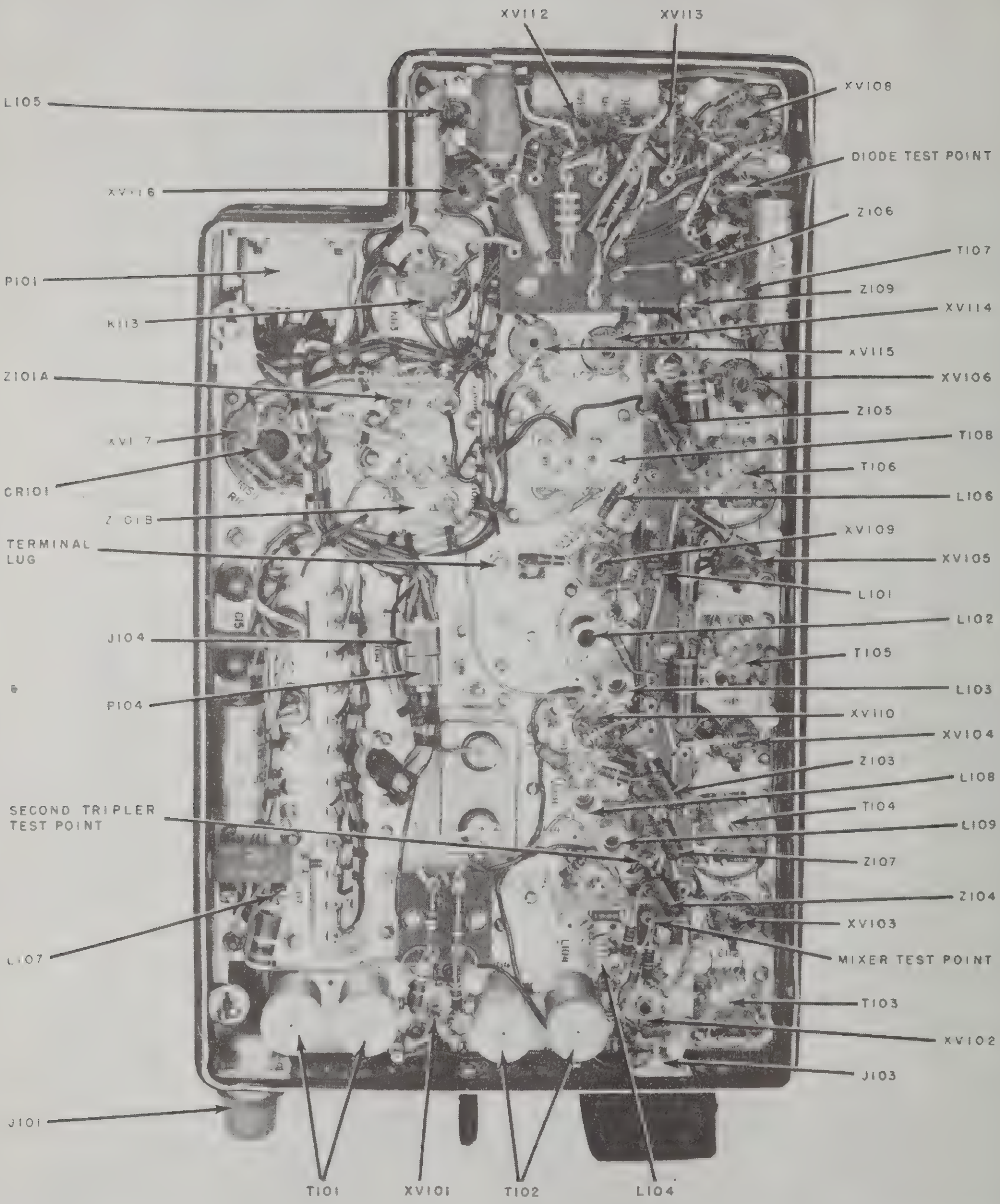


Figure 29. Radio Receiver R–746/AR, bottom view, parts location.

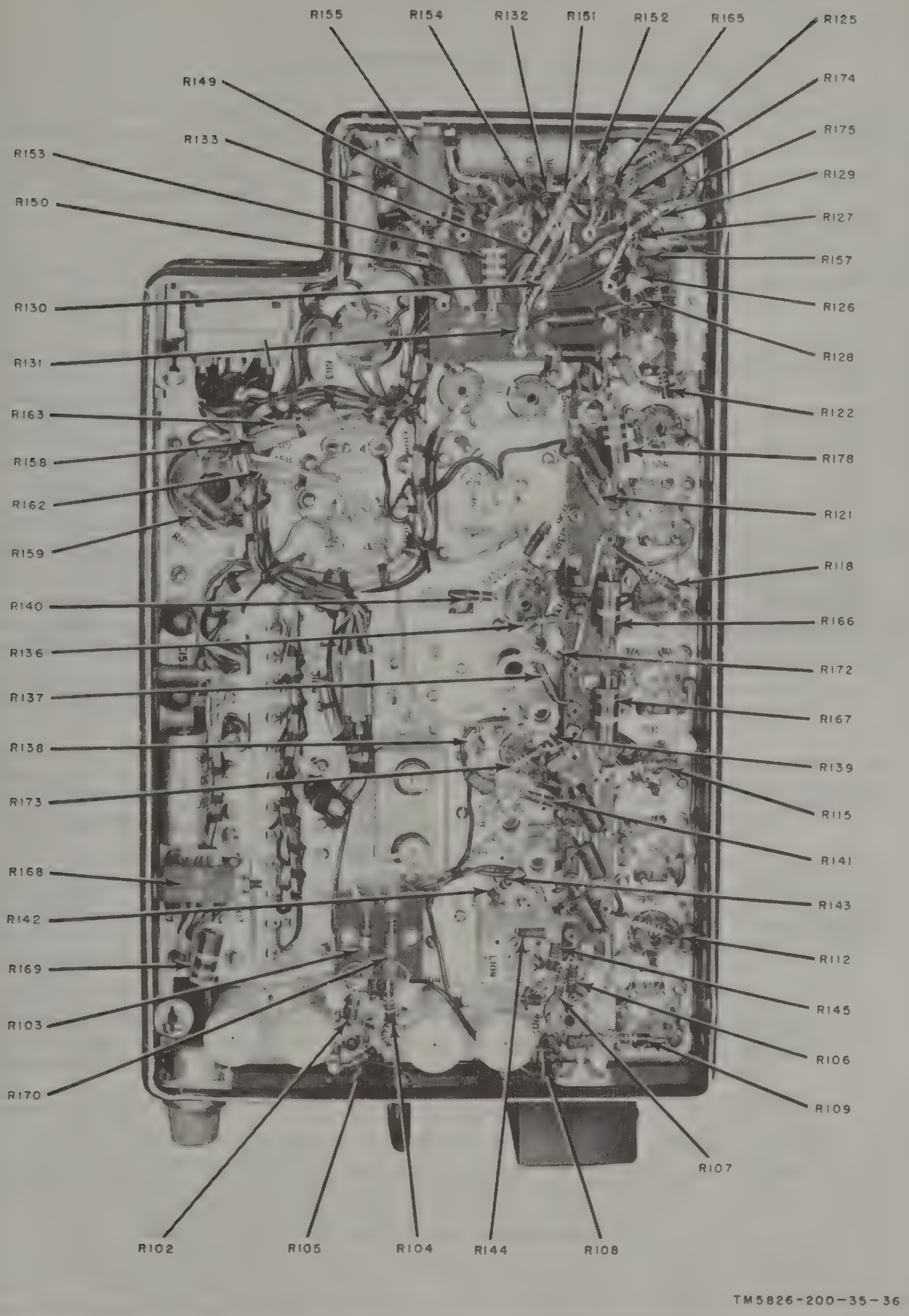


Figure 30. Radio Receiver R–746/AR, bottom view; resistor location.

d. Troubleshooting Chart.

Note. Perform the operations in the equipment performance check list before using this chart, unless the trouble has already been localized.

Item	Indication	Probable trouble	Procedure
1	Tubes fail to light with receiver on.	Primary power source at fault, defective cables or connectors.	Check primary power with voltmeter. Check cables with ohmmeter.
2	No output, no hum at test jack J103 (if there is some output and/or hum, see item 3 or 4).	Defective audio stage	Check V112 by substitution. Make voltage and resistance measurements.
3	No output, slight hum at test jack.	Defective detector stage	Check V107 by substitution. Make voltage and resistance measurements.
4	Weak output on all channels.	Receiver misalined Defective tube	Check tubes by substitution. Aline receiver (par. 44). Check tubes by substitution. Make signal substitution tests (par. 31). Make voltage and resistance measurements of defective stage.
5	No signal output at J103 when 18.9-mc modulated signal is applied to J102 (mixer grid).	IF stage defective	Check tubes by substitution. Take voltage and resistance measurements on V103, V104, V105, and V106.
6	Rushing noise but no signal for any channel.	RF or oscillator stage defective	Check tubes by substitution. Make voltage and resistance measurements. Make signal substitution tests (par. 31).
7	New channel is not selected when crystal selector switch is changed.	Defective relay (K101 through K111) No +27.5 energizing voltage	Check action of relays individually; also check for opens or shorts with ohmmeter. Check 27.5 voltage source.
8	400-cycle hum present at receiver test jack J103.	Rectifier tube V114 or V115 defective	Check V114 and V115 by substitution.
9	800-cycle hum present at receiver test jack J103.	Defective filter capacitor	Check filter capacitors C153 and C152 individually with ohmmeter. (Disconnect one side of capacitor being tested.)
10	Low frequency oscillation (motorboating).	Open IF screen-grid bypass capacitor. Open AF control-grid circuit	Temporarily bridge capacitors C119, C117B, C121B, and C124A with a known good capacitor of the proper value. Check dc path from pins 7 and 3 of V112 and ground.
11	Distorted signal	Weak tube. Incorrect voltage on tube. Leaky capacitor, such as C148 or C146. No agc voltage (receiver blocks with a strong signal).	Check all tubes and replace if necessary. Check agc voltage. Check plate and screen-grid voltages and resistances.
12	Receiver output noisy when AUDIO GAIN is varied.	Defective control R171	Connect ohmmeter between end of R171 and arm. Rotate shaft. Resistance should vary smoothly. Replace if necessary.

Item	Indication	Probable trouble	Procedure
13	Noisy receiver	Noisy antenna location	Short circuit antenna to ground. A considerable decrease indicates a noisy signal from the antenna. Use an insulated prod to tap each tube.
		Poor connection or shorting elements within a tube.	If tapping a tube causes more noise in the output, replace the tube with a new one.
		Loose connection at terminal or part	Tap the parts. Move terminals slightly and listen for noisy output. Noise may indicate that a connection should be soldered or that a part should be replaced.
14	No voltage present at 1st tripler test point for any channel.	Defective tube V109 or V110	Check V109 and V110 by substitution.
		Incorrect voltage on tube	Make voltage and resistant measurements.
15	No voltage present at 2nd tripler test point for any channel.	Defective tube V110 or V111	Check V110 and V111 by substitution.
		Incorrect voltage on tube	Make voltage and resistance measurements.
16	No voltage present at 1st tripler test point for one channel only.	Defective crystal	Check crystal for channel involved by substitution.
		Defective relay	Check action of relay for channel involved.
17	No voltage present at mixer test point (vtvm measurement).	Defective tube V101 or V102	Check V101 and V102 by substitution.
		Incorrect voltage on tube	Make voltage and resistance measurements.
18	No receiver B+ voltages Voltages normal at P101	Defective tubes V114 and V115	Check V114 and V115 by substitution.
		Defective T108. Open L107A Shorted C153 or C152	Make resistance checks on suspected components.

31. Signal Substitution

Signal substitution procedures help to localize troubles to a stage of the receiver. An externally generated signal is substituted for the signal normally present in each stage. Note the volume and listen for distortion from the headset at various points in the signal substitution procedure. When working back from the output to the input stages, decrease the output of the signal generator as much as possible. If possible, compare results with a receiver known to be in good operating condition.

32. Signal Substitution Charts

The charts in *a* and *b* below will aid in localizing troubles to a stage of the receiver. The test equipment listed in paragraph 27 is required for the test listed in these charts.

a. Audio Chart. Connect the headset to test jack J103 for an indication of tone.

Signal frequency	Connection to	Possible trouble
1,000 cycles	V112 pin 1 (plate) (Use blocking capacitor).	Defective headset or test jack connection, faulty C147.
1,000 cycles	V112 pin 3 (grid)	Defective V112; open L105, and R154.
1,000 cycles	V112 pin 6 (plate) (Use blocking capacitor).	Open C146.
1,000 cycles	V112 pin 7 (grid)	Defective V112; open R149, R171, R148, or R146.

b. Amplitude-Modulated IF Chart. The chart below is used after the trouble has been localized to the IF section. Connect the output of the signal generator to the points indicated. Connect the headset to test jack J103. The signal generator is set for 18.9-mc, modulated.

Connection to	Possible trouble
V106 pin 5 (use blocking capacitor).	Defective T107, defective detector tube V107, open R124 or C148, shorted C131C.
V106 pin 1	Defective V106, open primary T107, open R123, Z109, or R122, shorted C126, C125A, C125B, or C125C.
V105 pin 5 (use blocking capacitor).	Defective T106, shorted C122 or C123.
V105 pin 1	Defective V105, open primary of T106, open R119 or R118, shorted C121A or C121B.
V104 pin 5 (use blocking capacitor).	Defective T105.
V104 pin 1	Defective V104, open primary of T105, open R116 or R115, shorted C117A or C117B.
V103 pin 5 (use blocking capacitor).	Defective T104.
V103 pin 1	Defective V103, open primary of T104, open R113, Z103, or R112, shorted C113 or shorted C149.

33. Agc Characteristics (Course Softening) Check

Follow the procedure outlined below when the output of the receiver is abnormally low or distorted and the tubes are operating satisfactorily (as indicated by a tube checker). Connect the test set, signal generator, 6-db pad, and the receiver as shown in the test setup diagram (fig. 26) and limit values for the test.

a. Set the CHANNEL selector switch on the test set to channel 13. Adjust the signal generator to apply a 332-mc signal into the receiver.

b. Set the signal generator attenuator controls to the amplitude specified in the *input signal level* column of the chart (*e* below).

c. Set the DB RATIO control first to the 2-db position on the 90-cycle side, and then to the 2-db position on the 150-cycle side. Note the readings of the test set DEVIATION meter for both positions of the DB RATIO control.

d. Add the current values obtained from the DEVIATION meter to obtain a total deflection current for a 2-db ratio between the 90- and 150-cycle signals in both directions. Total deflection current value obtained by this addition should be within the limits shown in the *total deflection current limits* column.

e. Return the DB RATIO to its 0-db position, and note the current reading of the DEVIATION meter for this balanced condition. Current values for the balanced condition should be within the limits shown in the *balanced condition current limits* column.

Input signal level (uv)	Total deflection current limits (ua) (d above)	Balanced condition current limits (ua) (e above)
700	154–158	2.0
30	138–220	±5.0
14,000	112–138	±5.0
100,000	88–128	±5.0

34. Audio Gain Control Check

Connect the equipment as described in paragraph 33.

a. Set the receiver flag current control R161 fully clockwise.

b. Set the signal generator attenuator to 700 microvolts at a frequency of 332-mc output.

c. Set the CHANNEL selector switch on the test set to channel 13.

d. Set the DB RATIO control to 2 db on the 90-cycle side.

e. Vary the receiver audio gain control R171, to its full clockwise and counterclockwise positions; note the current readings on the DEVIATION meter of the test set, for each limit position of the control. Maximum current reading should be at least 100 microamperes; minimum current should be less than 75 microamperes.

f. Reset audio gain control R171 to obtain a 140-microampere reading on the DEVIATION meter. Readjust deflection sensitivity control R164 to obtain a 78-microampere average reading for both 2-db ratios between 90- and 150-cycle signals.

35. Selectivity (at 6-db, 60-db, and 75-db Points) Check

To make the selectivity check, a variable bias voltage supply must be used in conjunction with the signal generator and the test set. This bias supply can be a 4.5-volt battery, feeding its voltage across a potentiometer. The purpose of the bias supply is to apply a potential, between —4.5 and 0 volts, to a point in the agc circuit of the receiver. The selectivity check determines the bandwidth of a particular channel of the receiver for attenuation values of 6, 60, and 75 db. To determine the bandwidth, an input signal of a fixed value (700 microvolts) is fed into the receiver, and the auxiliary bias supply is connected to feed —4.5 volts dc to agc test point C132B in the receiver. This variable bias voltage is then slowly adjusted toward 0.0 volt, until a reading of 200 microamperes is obtained on the FLAG CURRENT meter of the test set. The input signal is then increased in amplitude by 6 db (2X), and the signal generator frequency is varied until the FLAG CURRENT meter again reads 200 microamperes. This indicates that the signal is being attenuated by 6 db at the particular frequency being fed into the receiver at this time. The input signal is then varied in frequency in the opposite direction, until a second point is obtained at which the FLAG CURRENT meter reads 200 microamperes. This is the second frequency, or the other end of the band pass at which input signals are attenuated by 6 db. Similar techniques are used to measure the bandwidth for 60- (1000 X) and 75-db (5623 X) attenuation.

36. Flag Alarm Control Range Check

For the test set flag alarm control range check, place the METER RANGE switch in its 0-1MA position and proceed as follows:

a. Set the signal generator attenuator to 100,000 microvolts.

b. Vary the receiver flag alarm control R171 to obtain a maximum current reading on the FLAG CURRENT meter of the test set. The FLAG CURRENT meter should read at least 850 microamperes.

c. Reset the flag alarm control to obtain a 275 micromaperes reading on the flag alarm current meter.

37. Receiver Balance Control Range Check

With the signal generator attenuator set to 700 microvolts, set the DB RATIO control to its 0 position; then check the range of adjustment of the balance control R156 as follows:

a. Vary the receiver balance control R156 to its full clockwise and counterclockwise positions; note the current readings on the test set DEVIATION meter for each control limit. The current reading should be at least 20 microamperes on either side of the zero meter mark.

b. Reset the balance control for zero-current meter readings.

38. General Precautions

Whenever a receiver is to be serviced, observe the following precautions very carefully:

a. Make sure that the receiver is disconnected from the power source or is turned off before contacting exposed circuits or changing connections.

b. After removal of a major part, such as a transformer, note its position with respect to an adjacent major part.

c. Careless replacement of parts often makes new faults inevitable. Note the following points:

(1) Before unsoldering a part, note the position of the leads. If the part has a number of connections, tag each of its leads.

(2) Be careful not to damage other leads while pulling or pushing them out of the way.

(3) Do not allow drops of solder to fall into the receiver, since they may cause short circuits.

(4) A carelessly soldered connection may create a new fault. It is very important to make well-soldered joints, since a poorly soldered joint is one of the most difficult faults to find.

(5) *When replacing a part in the RF or IF circuits, place it in the exact position of the original part. A part that has the same electrical value but different physical size may cause trouble in a high-frequency circuit. Give particular attention to proper grounding when replacing a part. Use the same ground as the original wiring. Failure to observe these precautions may result in decreased gain, or possibly, in oscillation of the circuit.*

39. Isolating Trouble Within a Stage

When the trouble has been localized to a stage, either through operational checks or signal substitution (par. 31), use the following techniques to isolate the defective part:

a. Test the tube involved, either in the tube tester or by substituting a similar type tube which is known to be operating normally.

b. Take voltage measurements at the tube sockets (fig. 25) and other points related to the stage in question.

c. If voltage readings are abnormal, take resistance readings (fig. 25) to isolate open and short circuits. Refer also to the dc resistance of transformers and coils in paragraph 40.

d. If signals are weak and all checks fail to indicate a defective part, check the alinement of the receiver (par. 44).

e. Use the schematic diagram (fig. 34) to circuit trace and isolate the faulty component.

40. Dc Resistance of Transformers, Coils, and Relays

The dc resistances of the transformer windings, coils, and relays in the receiver are listed below:

Transformer, coil, or relay	Terminals	Ohms
T103	1–2	Less than 1
	2–3	100K
	4–5	Less than 1
	5–6	4.7K
T104	1–2	Less than 1
	2–3	100K
	4–5	Less than 1
	5–6	4.7K
T105	1–2	Less than 1
	2–3	100K
	4–5	Less than 1
	5–6	4.7K
T106	1–2	Less than 1
	2–3	100K
	4–5	Less than 1
	5–6	4.7K
T107	1–2	Less than 1
	4–5	4.8K
	5–6	4.7K
T108	1–2	12
	3–4	125
	4–5	125
	3–5	250
L101	Across winding	10
L102	Across winding	Less than 1
L103	Across winding	Less than 1
L104	Across winding	Less than 1
L105	Across winding	2000
L106	Across winding	Less than 1
L107A	1–2	200
L107B	2–3	110
L108	Across winding	Less than 1
L109	Across winding	Less than 1
L110	Across winding	Less than 1
K101	5–chassis	500
K102	6–chassis	500
K103	7–chassis	500
K104	8–chassis	500
K105	9–chassis	500
K106	10–chassis	500
K107	11–chassis	500
K108	12–chassis	500
K109	13–chassis	500
K110	14–chassis	500
K111	20–chassis	500
K113	1–8 (All other pins are open until relay is energized.)	10

CHAPTER 4

REPAIRS AND ALINEMENT

Section I. REPAIRS

41. General Parts Replacement Techniques

Most of the parts in Radio Receiver R–746/AR can be readily replaced without special procedures. However, as the resonant frequency of a given tuned circuit is increased, the electrical and, usually, the physical size of the inductor and the capacitor decrease. The wiring (lead dress) and the location of parts increase in importance. The following precautions apply specifically to this receiver.

a. Before removing a part in the RF amplifier (V101), the mixer (V102) and the oscillator circuits (V109, V110, and V111), note the position of the part and its leads. Wire replacement parts in essentially the same position to avoid undesired coupling and spurious oscillations.

b. When the feedthrough capacitors are being soldered, be careful to prevent the glass portion (insulators) from cracking when the center conductor gets hot. Grasp the central lead with a pair of pliers between the insulator and the eye of the terminal before applying heat.

42. Removal and Replacement

Instructions for removing and replacing the subchassis and various detail parts of the receiver and control panel for bench-testing or repair are given in *a* through *e* below. When replacing the subchassis, the machine nuts should first be started, one at a time, in order to locate the subchassis before tightening the nuts all the way. When replacing multicontact plugs (P101 or P104), be sure the pins are properly aligned with the receptacle contacts. These pins are easily bent.

a. Side Panels.

(1) *Removal* (fig. 31). Detach the receiver from the mounting by unscrewing the thumbscrew on the front of the mounting and proceed as follows:

(*a*) Unscrew the four captive screws (spring loaded) at the bottom edges of the side panels by turning the screws in a counterclockwise direction (approximately ¼ turn).

(*b*) Lift off the side panels.

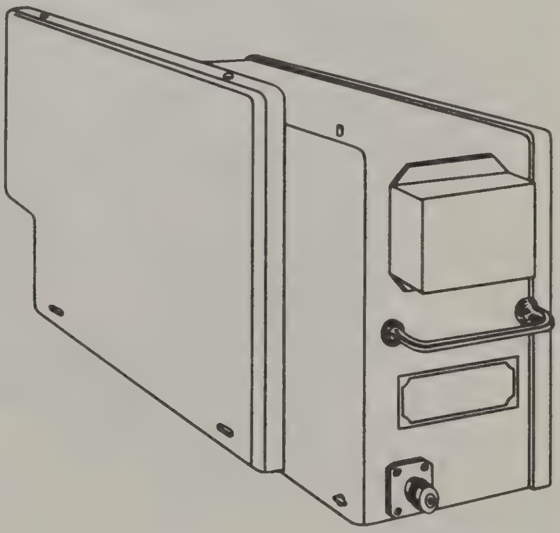
(2) *Replacement.*

(*a*) Hold the side panel at an angle and connect the two top hook fasteners.

(*b*) Allow the bottom edge of the side panel to drop in place. Press firmly with the palm of the hand to insure proper seating.

(*c*) Tighten the captive screws (two on the bottom edge of each panel) in a clockwise direction.

(*d*) Secure the receiver, completely assembled, on the mounting by tightening the thumbscrew on the front of the mounting. Apply hand pressure only, use no tools.



TM5826-200-3

Figure 31. Removal of receiver side panels.

b. Crystal Bank Subchassis.

(1) *Removal* (fig. 32).

- (*a*) Remove the receiver from the mounting base.
- (*b*) Remove the side panels.
- (*c*) Unsolder the lead connected to the terminal lug.
- (*d*) Disconnect plug P104 from jack J104.
- (*e*) Place the receiver in its normal position.
- (*f*) Remove the five machine nuts and carefully lift the subchassis from the main frame.

(2) *Replacement.*

- (*a*) Hold the crystal subchassis directly above its normal position on the main frame. Make sure all five threaded mounting studs on the subchassis are lined up with the associated holes on the main frame.
- (*b*) Gently guide the subchassis in place; be careful to avoid kinks in the P104 cable.
- (*c*) Place the five lockwashers on the five protruding mounting studs underneath the chassis.
- (*d*) Place the five machine nuts on the mounting studs and tighten.
- (*e*) Connect plug P104 to pack J104.
- (*f*) Replace the side panels and replace the receiver on the mounting base.

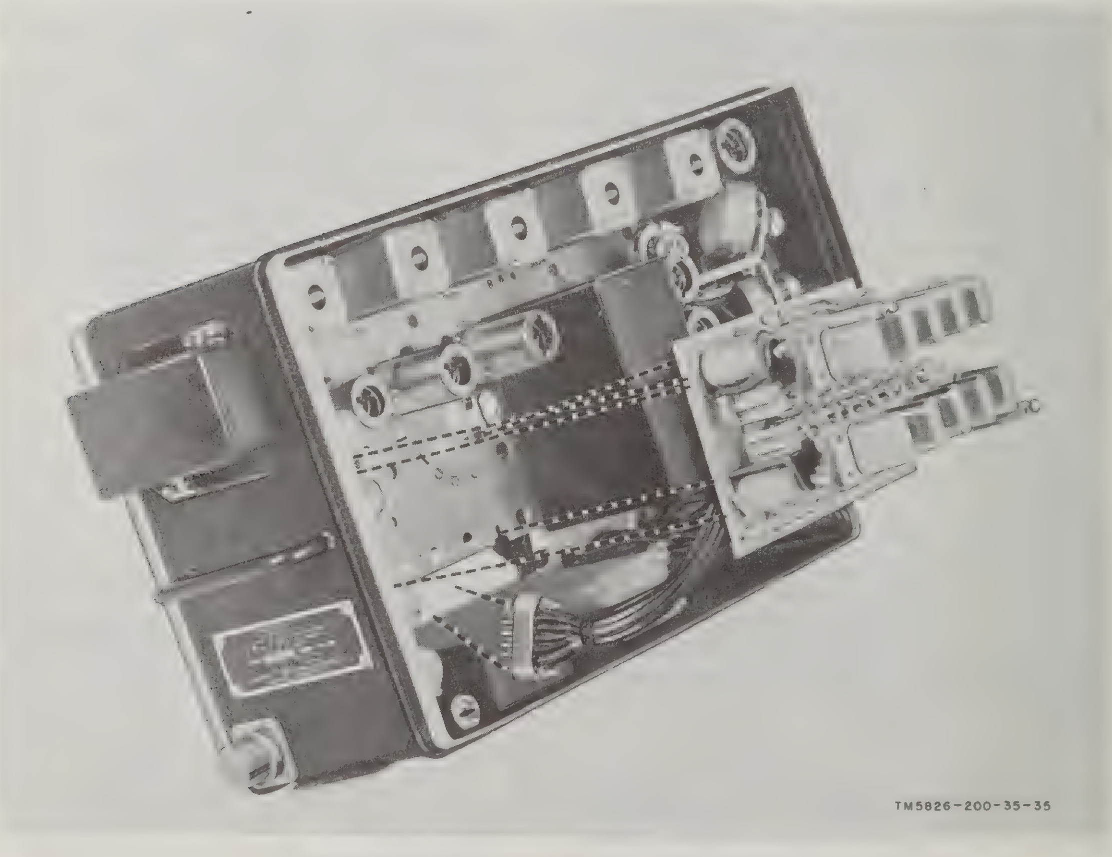


Figure 32. Removal of crystal relay bank subchassis.

c. VOL Control.

(1) *Removal* (fig. 33). Proceed as follows:

(*a*) Detach the control panel by removing the four screws along the outer edge of the panel.

(*b*) Unsolder and tag (for identification purposes) the two leads connected to the two rear terminals (*on-off* switch)

(*c*) Unsolder and tag the one lead connected to the potentiometer (volume control) lug.

(*d*) Unsolder and remove the 1,800-ohm resistor (R148).

(*e*) Disconnect and remove the VOL control.

(2) *Replacement.*

(*a*) Seat the control in the opening provided at the base of the wafer switch.

(*b*) Place the nut over the protruding control shaft and tighten.

(*c*) Insert the shaft from the front center to the rear of the control panel.

(*d*) Tighten the Allen screw on the control shaft.

(*e*) Solder the 1,800-ohm resistor in place (between the two extreme terminals of the volume control)

(*f*) Solder the one tagged lead to the center lug of the volume control.

(*g*) Solder the two tagged leads to the two terminals at the base of the control.

(*h*) Replace the control panel and secure it with the four screws along the outer edge of the panel.

d. Lamp Holder.

(1) *Removal* (fig. 33). Proceed as follows:

(*a*) Remove the control panel as outlined in *c* above.

(*b*) Loosen and remove the nut and washer behind the mounting plate.

(*c*) Unsolder the lead connected to the base of the holder (behind the mounting plate).

(*d*) Remove the lamp and rubber washer.

(*e*) Loosen the Bristo screws on the two knobs, the calibrated drum, and the flange. Remove the VOL knob.

(*f*) Loosen and remove the two machine screws that secure the three plates.

(*g*) Remove the standoff assembly.

(*h*) Remove, by pulling straight out, the remaining knob, cover plate, flange, calibrated drum, front plate, and lamp holder.

(2) *Replacement.*

(*a*) Replace the following parts, in the order given, by sliding them over the shaft.

1. Lamp holder.

2. Front plate.

3. Calibrated drum.

4. Flange.

5. Cover plate.

6. Larger knob.

(*b*) Place the standoff assembly between the front plate and the cover plate.

(*c*) Insert and tighten the two machine screws, with washers, through the standoff assembly.

(*d*) Replace the VOL knob.

(*e*) Tighten the Bristo screws on the calibrated drum, the flange, and the two knobs.

(*f*) Replace the lamp and rubber washer.

(*g*) Replace and tighten the nut and washer that secure the holder in place.

(*h*) Reconnect and solder the lead to the base of the lamp holder.

e. Wafer switch.

(1) *Removal.* To remove the entire switch as one unit (fig. 33), proceed as follows:

(*a*) Remove the VOL control as outlined in *c* above.

(*b*) Remove the shaft connected to the VOL knob by pulling it straight out.

(*c*) Remove the remaining knob, cover plate, standoff assembly, flange, calibrated drum, lamp, and front pal plate as outlined in *d* above.

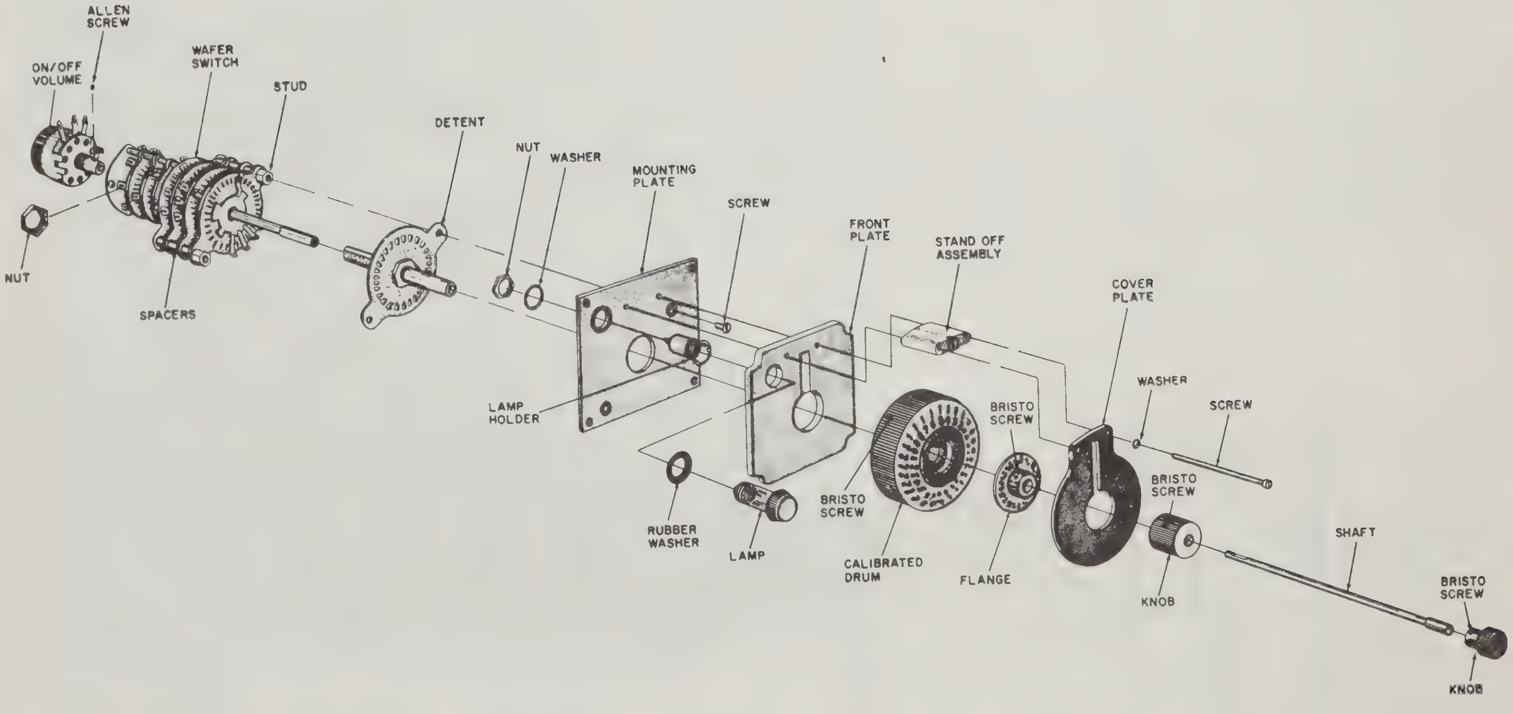


Figure 33. Exploded view of Receiver Control C–2065/AR.

(*d*) Remove the two flat head machine screws connected through the tips of the detent to the mounting studs of the wafer switch assembly.

(*e*) Slide the detent off the switch assembly shaft.

(2) *Replacement.* To replace the wafer switch, proceed as follows:

(*a*) Replace the detent on the wafer switch assembly.

(*b*) Line up the holes on the detent, switch studs, and mounting plate. Replace the two flat head machine screws.

(*c*) Replace the front plate, lamp, calibrated drum, flange, standoff assembly, cover plate and knob as outlined in *d* above.

(*d*) Replace the shaft connected to the VOL control knob.

(*e*) Replace the VOL control as outlined in *c* above.

Section II. ALINEMENT

43. Test Equipment Required for Alinement

a. The following test equipment and special tools are required for alinement of Radio Receiver R–746/AR:

Item	Technical manual
Signal Generator AN/GRM–4	See note (Par. 27)
Electronic Equipment Maintenance Kit MK–428/AR.	See note (Par. 27)

b. In addition, the following items are required for alinement:

(1) A 52-ohm, 6-db pad to be connected between the signal generator and the receiver input.

(2) A +24 to +30-volt dc supply.

(3) A variable bias supply capable of producing —4.5 volts dc.

44. Alinement Procedure

Connect the equipment as shown in the test setup diagram (fig. 26). Place the test set POWER switch in its ON position; allow about 15 minutes for the receiver to warm up; then place the test set RECEIVER switch in its ON position. The receiver is now fully energized.

a. Set the signal generator attenuator to 700 microvolts. Set modulation levels for 40 percent (for both 90 and 150 signals).

b. Set the CHANNEL switch on the test set to channel 13; set the signal generator output for 332 megacycles.

c. Set the deflection sensitivity control R164 fully clockwise.

d. Set the DB RATIO control to 0 position and adjust R156 in the receiver to obtain 0 microamperes on the DEVIATION meter.

e. Set the DB RATIO control to 2 position on the 90-cycle side, and set audio gain control R171 to obtain 140 microamperes on the DEVIATION meter.

f. Set the DB RATIO control to 0 position and readjust R156 to obtain a zero reading on the DEVIATION meter, if necessary.

g. Set the DB RATIO control to 2 position on the 150-cycle side and adjust R164 to obtain 78 microamperes on the DEVIATION meter.

h. Reset the DB RATIO control to 0 position and reset control R156 to obtain 0 microamperes on the meter, if required.

i. Increase the signal generator attenuator setting to 100,000 microvolts and set flag alarm control R161 to get a 275-microamperes reading on the FLAG CURRENT meter of the test set. METER RANGE switch should be in the 0–0.5 MA position. If the controls of the receiver under test cannot be set to obtain the designated current values for any of the above steps, and the faulty receiver must be repaired.

j. With the signal generator attenuator set to 700 microvolts and both the receiver and generator set for 332-megacycle channel operation, proceed as follows:

(1) Set the DB RATIO control first to its 2 position on the 90-cycle side, and then to its 2 position on the 150-cycle side. Note the current readings on the DEVIATION meter for both positions of the DB RATIO control.

(2) Add the current values noted in (1) above, to obtain a total deflection current value of approximately 156 microamperes.

(3) Return the DB RATIO control to its 0 position, and note the current reading on the DEVIATION meter for this balanced condition. For this channel, the reading should be exactly zero microamperes.

(4) Change the position of the CHANNEL selector switch on the test set to select another channel of the receiver. Retune the signal generator, so that it applies a signal of the correct frequency for the selected channel, into the receiver.

(5) Set the DB RATIO control of the signal generator first to its 2 position on the 90-cycle side, then to its 2 position on the 150-cycle side. The current readings on the DEVIATION meter for both positions of the DB RATIO control added together should be between 150 and 162 microamperes.

(6) Reset the DB RATIO control of the signal generator to its 0 position. The current reading at this time should be zero ±3.0 microamperes.

(7) Repeat the procedures given in (4) through (6) above for the remaining channels of the receiver.

(8) For each channel of the receiver, tune the signal generator to apply a signal of the correct frequency for that channel into the receiver, and adjust the DB RATIO control to its 2 position on the 90-cycle side of the 0 position. Slowly adjust the amplitude of the input signal, from a minimum value, until the current reading of 70 microamperes is obtained on the DEVIATION meter of the test set. Note the value of input signal necessary to achieve the 70-microampere reading. For any channel, this should be 30 microvolts or less (maximum variation between channels in minimum input signal necessary to obtain a 70-microampere deflection current should be less than 3 db).

45. Deflection Sensitivity Control Range Check

With the signal generator and test set controls set as described in paragraph 33, proceed as follows:

a. Vary deflection sensitivity control R164 to its full clockwise and counterclockwise positions and note readings of DEVIATION meter for both control limit positions. (Minimum current reading should be less than 35 microamperes; maximum current should be more than 135 microamperes.)

b. Reset the deflection sensitivity control for 78 microamperes average readings on the DEVIATION meter for 2-db ratios between 90- and 150-cycle signals.

CHAPTER 5

FINAL TESTING

46. Purpose of Final Testing

The tests outlined in this chapter are designed to measure the performance capability of a repaired receiver. Equipment that meets the minimum standards stated in the tests will furnish operation equivalent to that of new equipment.

47. Test Equipment Required for Final Testing

The test equipment required for final testing is the same as that listed for troubleshooting (par. 27). Refer to the appropriate technical manuals for instructions on the use of the test equipment.

48. Test Setup

Perform the tests under the conditions listed in *b* through *p* below and illustrated in figure 26.

a. The table below lists the channel-crystal-frequency assignments for Radio Receiver R–746/AR:

Channel	Active crystal	Frequency output (mc)
1	Y118	334.4
2	Y119	334.7
3	Y120	335.0
4	Y101	329.3
5	Y102	329.6
6	Y103	329.9
7	Y104	330.2
8	Y105	330.5
9	Y106	330.8
10	Y117	334.1
11	Y108	331.4
12	Y109	331.7
13	Y110	332.0
14	Y111	332.3
15	Y112	332.6
16	Y113	332.9
17	Y114	333.2
18	Y115	333.5
19	Y116	333.8
20	Y107	331.1

b. Set the signal generator attenuator to 18 microvolts, at the correct frequency for the particular channel selected by the CHANNEL switch on the test set.

c. Attach the variable bias supply (at —4.5 volts dc) to feed its negative voltage to agc test point C132B in the receiver. Slowly reduce the amplitude of this negative potential until the reading of 200 microamperes is obtained on the FLAG CURRENT meter of the test set.

d. Increase the signal generator attenuator to the 36 microvolt position.

e. Vary the frequency output of the signal generator, watching the FLAG CURRENT meter, until the FLAG CURRENT meter again indicates 200 microamperes. If necessary, rezero the signal generator as its output frequency is varied, to insure that the generator output is exactly 36 microvolts in amplitude.

f. Note the frequency of the signal generator at this time.

g. Vary the signal generator frequency in the opposite direction from that indicated in *a* above, until a second point is found at which the FLAG CURRENT meter again indicates 200 microamperes of flag current.

h. Note the frequency of the signal generator output at this time.

i. Determine the difference value between the two frequencies noted in *f* and *h* above; this difference is the bandwidth of the channel at the 6-db attenuation points. (Bandwidth at the 6-db attenuation points should be 135 kilocycles or more.)

j. Increase the signal generator attenuator to 18,000 microvolts, and vary the frequency in one direction until the FLAG CURRENT meter again indicates 200 microamperes. Note the frequency of the signal generator output at this time.

k. Vary the signal generator output frequency in the opposite direction until a second point is found at which the FLAG CURRENT meter again indicates 200 microamperes. Note the signal generator output at this time.

l. Determine the difference between the frequencies noted in steps (*j* and *k*); this is the channel bandwidth at the 60-db attenuation points. (Bandwidth at 60-db attenuation points should be 500 kilocycles or less.)

m. Increase the signal generator attenuator to 100,000 microvolts position. Vary the generator output frequency until a point is located at which the FLAG CURRENT meter indicates 200 microamperes again. Note the frequency of the generator output at this time.

n. Vary the signal generator output frequency in the opposite direction until a second point is located at which the FLAG CURRENT meter again indicates 200 microamperes. Note the generator output frequency at this time.

o. Determine the difference between the frequencies noted in steps *m* and *n*; this value is the bandwidth of the channel at the 75-db attenuation points. (Bandwidth at 75-db attenuation points should be 600 kilocycles or less.)

p. Repeat steps *b* through *o* above for all channels of Radio Receiver R–746/AR.

APPENDIX

REFERENCES

TM 11–5826–200–12, Radio Receiver R–746/AR, Operation and Organizational Maintenance.

TM 11–520, Radio Receiving Set AN/ARN–30, Operation and Maintenance.

TM 11–520A, Radio Receiving Set AN/ARN–30A, Operation and Service Instructions.

[AG 413.44 (28 Apr 59)]

By Order of *Wilber M. Brucker*, Secretary of the Army:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:
R. V. LEE,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

- ASA (2)
- CNGB (1)
- Tech Stf, DA (1) except
  - CSigO (30)
- Tech Stf Bd (1)
- USA Arty Bd (1)
- USA Armor Bd (1)
- USA Inf Bd (1)
- USA AD Bd (1)
- USA Abn & Elct Bd (1)
- USA Avn Bd (1)
- USA Armor Bd Test Sec (1)
- USA AD Bd Test Sec (1)
- USA Arctic Test Bd (1)
- USCONARC (5)
- US ARADCOM (2)
- US ARADCOM Rgn (2)
- OS Maj Comd (5)
- OS Base Comd (5)
- Log Comd (5)
- MDW (1)
- Armies (5) except
  - First US Army (7)
- Corps (2)
- Div (2)
- USATC (2)
- Svc Colleges (5)
- Br Svc Sch (5) except
  - USASCS (25)
- Gen Dep (2) except
  - Atlanta Gen Dep (none)
- Sig Sec, Gen Dep (10)
- Sig Dep (17)
- Army Pictorial Cen (2)
- Engr Maint Cen (1)
- USA Ord Msl Comd (3)
- Fld Comd, AFSWP (5)
- TASSA (15)
- Mid-Western Rgn Ofc (TASSA) (1)
- USA Sig Pub Agcy (8)
- USA Sig Engr Agcy (1)
- USA Comm Agcy (2)
- USA Sig Eqp Spt Agcy (2)
- USA Sig Msl Spt Agcy (13)
- WRAMC (1)
- AFIP (1)
- AMS (1)
- Ports of Emb (OS) (2)
- Trans Terminal Comd (1)
- Army Terminals (1)
- OS Sup Agcy (2)
- Yuma Test Sta (2)
- USA Elct PG (1)
- Sig Lab (5)
- Sig Fld Maint Shops (3)
- Mil Dist (1)
- USA Corps (Res) (1)
- Sector Comd, USA Corps (Res) (1)
- JBUSMC (2)
- Units org under fol TOE:
  - 11–7 (2)
  - 11–16 (2)
  - 11–57 (2)
  - 11–500 (AA–AE) (2)
  - 11–557 (2)
  - 11–587 (2)
  - 11–592 (2)
  - 11–597 (2)

NG: State AG (3); units—same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see AR 320–50.

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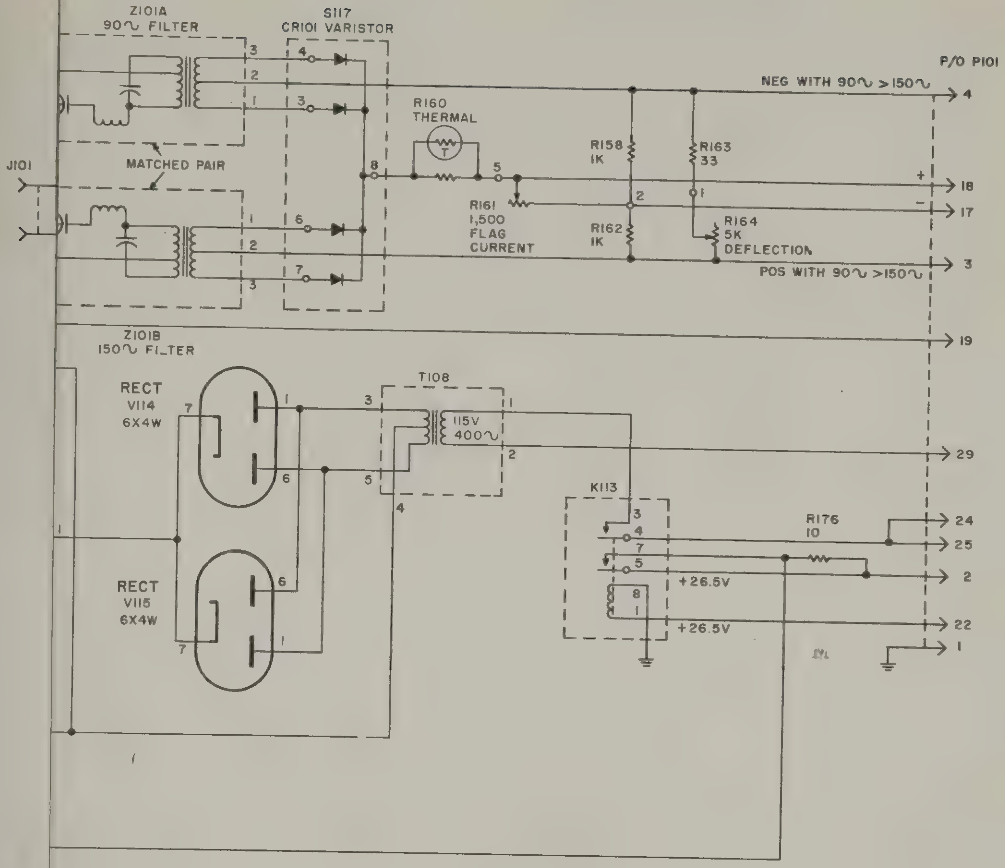
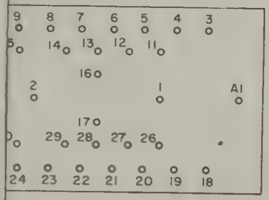


NOTES:

THERWISE INDICATED;
ES ARE IN OHMS,
CES ARE IN UUF.
R158 MATCHED TO ±2%

4. RELAY K113 IS SHOWN DE-ENERGIZED.

P101



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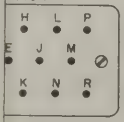
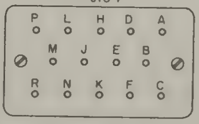


J104



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- USA AD Bd (1)
- USA Abn & Elct Bd (1)
- USA Avn Bd (1)
- USA Armor Bd Test Sec (1)
- USA AD Bd Test Sec (1)
- USA Arctic Test Bd (1)
- USCONARC (5)
- US ARADCOM (2)
- US ARADCOM Rgn (2)
- OS Maj Comd (5)
- OS Base Comd (5)
- Log Comd (5)
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- Div (2)
- USATC (2)
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- Fld Comd, AFSWP (5)
- TASSA (15)
- Mid-Western Rgn Ofc (TASSA) (1)
- USA Sig Pub Agcy (8)
- USA Sig Engr Agcy (1)
- USA Comm Agcy (2)
- USA Sig Eqp Spt Agcy (2)
- USA Sig Msl Spt Agcy (13)
- WRAMC (1)
- AFIP (1)
- AMS (1)
- Ports of Emb (OS) (2)
- Trans Terminal Comd (1)
- Army Terminals (1)
- OS Sup Agcy (2)
- Yuma Test Sta (2)
- USA Elct PG (1)
- Sig Lab (5)
- Sig Fld Maint Shops (3)
- Mil Dist (1)
- USA Corps (Res) (1)
- Sector Comd, USA Corps (Res) (1)
- JBUSMC (2)
- Units org under fol TOE:
  - 11–7 (2)
  - 11–16 (2)
  - 11–57 (2)
  - 11–500 (AA–AE) (2)
  - 11–557 (2)
  - 11–587 (2)
  - 11–592 (2)
  - 11–597 (2)

NG: State AG (3); units—same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see AR 320–50.

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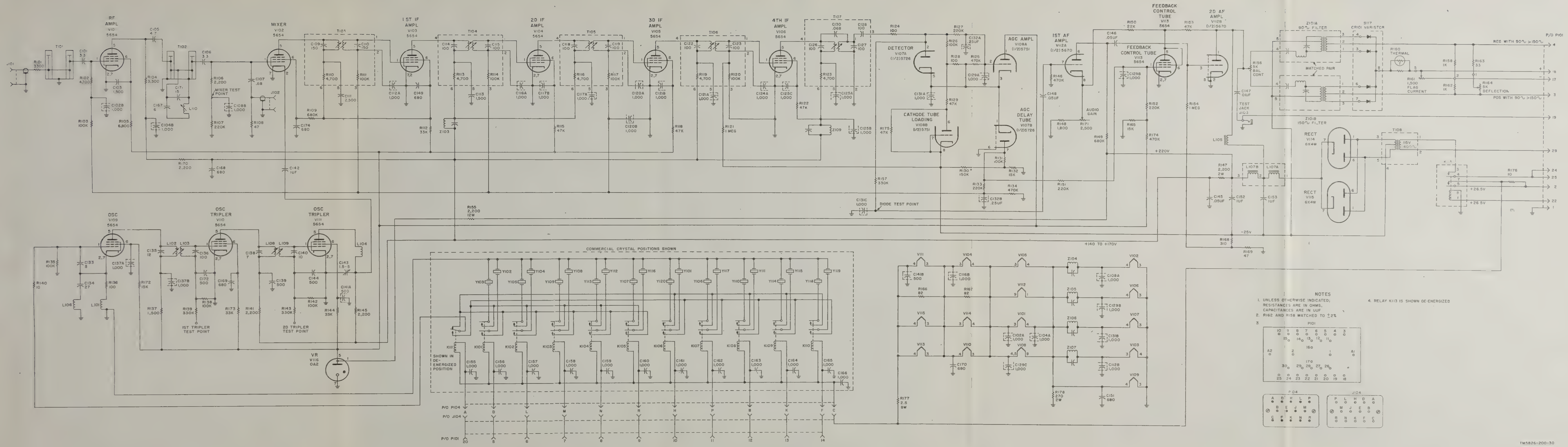

NOTES

1. UNLESS OTHERWISE INDICATED; RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF
2. R162 AND R158 MATCHED TO ±2%
3.
4. RELAY K113 IS SHOWN DE-ENERGIZED

Figure 34. Radio Receiver R–746/AR, schematic diagram.

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